



PCT/EP200 3 / 0 5 0 9 1 2
02 12 2003



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

REC'D 27 FEB 2004

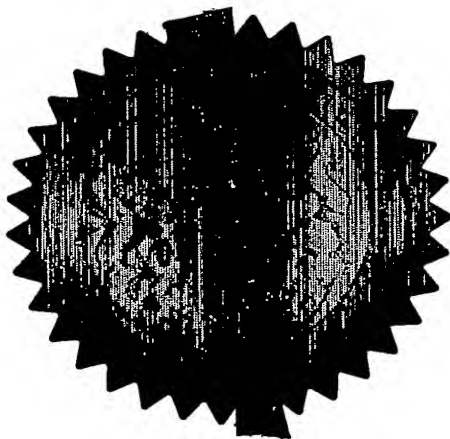
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



**PRIORITY
DOCUMENT**
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1 (a) OR (b)

Signed *Stephen Hordley*

Dated 3 October 2003

BEST AVAILABLE COPY

*Canley
Trawick*

Patents Form 1/77

OFFICE

Patents Act 1977
(Rule 16)

09 DEC 2002

RECEIVED BY FAX

The
Patent
Office

002 E769628-1 D03069

POL 47700 0.00-228647.4

1777

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road

Newport

Gwent NP9 1RH

1. Your reference GB Case PP/1-22811/P1/CHM 124

2. Patent application number
(The Patent Office will fill in this part)

0228647.4

3. Full name, address and postcode of the
or of each applicant
*(underline all surnames)*Ciba Specialty Chemicals Holding Inc
Klybeckstrasse 141
4057 Basel
SwitzerlandPatent ADP number *(if you know it)*

08468753001

If the applicant is a corporate body, give
the country/state of its incorporation

Switzerland

07660830003

4. Title of invention

Polymeric material containing a latent acid

5. Name of your agent *(if you have one)*"Address for service" in the United
Kingdom to which all correspondence
should be sent
*(including the postcode)*Ciba Specialty Chemicals Holding Inc
Patents Department
PO Box 38
Cleckheaton Road
Low Moor
Bradford
West Yorkshire
BD12 0JZPatents ADP number *(if you know it)*

08192080001

6. If you are declaring priority from one
or more earlier patent applications,
give
the country and the date of filing of the
or of each of these earlier applications
and *(if you know it)* the or each
application number

Country

Priority application number
*(if you know it)*Date of filing
(day/month/year)7. If this application is divided or
otherwise derived from an earlier UK
application, give the number and the
filing date of the earlier applicationNumber of earlier
applicationDate of filing
(day/month/year)8. Is a statement of inventorship and of
right to grant of a patent required in
support of this request? *(Answer 'Yes' if*

YES

a) *any applicant named in part 3 is not an
inventor, or*b) *there is an inventor who is not named as
an applicant, or*c) *any named applicant is a corporate body.**(see note (2))*

Patents Form 1/77

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form -
 Description 50
 Claim(s) 14
 Abstract 1
 Drawing(s) -

10. If you are also filing any of the following, state how many against each item.

Priority documents -
 Translations of priority documents -
 Statement of inventorship and right to grant of a patent (Patents Form 7/77) -
 Request for preliminary examination and search (Patents Form 9/77) 1
 Request for substantive examination (Patents Form 10/77) -
 Any other documents (please specify) -

11. I/We request the grant of a patent on the basis of this application

Signature

Date

Catherine Choppen

09 December 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Catherine Choppen

..... 01274 417445

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- d) Once you have filled in the form you must remember to sign and date it.
- e) For details of the fee and ways to pay please contact the Patent Office.

Patents Form 1/77

0054862:09-Dec-02:04:11

Polymeric material containing a latent acid

The present application relates to a method of coloring a polymeric material on irradiation using ultraviolet (UV) or high energy radiation, to a polymeric material containing a colour former and a phenolic antioxidant and/or phenolic ultraviolet absorber (UVA) as latent acid, i.e. a compound which is not an acid but which can be converted to an acid by the influence of irradiation, and to some specific uses of this material.

Recently, for real-time marking of letters and signs such as marker's name, product name, date of production, lot number etc. on the surfaces of various commercial articles, the laser marking system is popularly employed for its various advantages. However, the existing laser marking systems do not perfectly fulfill all the user's requirements and thus a need exists to improve the properties of such systems.

Some compositions containing color former and an acidic substance, which change color upon heating with a microwave laser, are shown in US-5824715 and EP-A-600441. WO 02/08821 reports a reversible thermochromic effect by combining a chromogenic compound with certain phenoles.

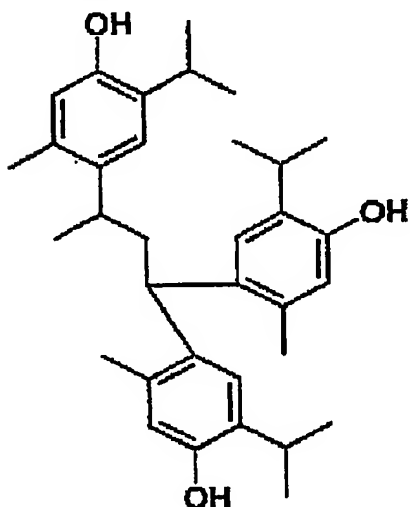
EP-A-290750 suggests the use of a nitrobenzaldehyde as an acid former in self-coloring, UV sensitive solutions. US-4343885 and EP-A-720053 describe some photopolymerizable compositions wherein color former is combined with a diazonium salt and/or certain halogenated compounds. A similar color generation is proposed in US-5677107.

It has now been found that phenolic antioxidants or phenolic UVAs present in a polymer matrix may split off a proton on irradiation with energy above visible light, and thus may function as a latent acid able to transform a colour former into a dye (irreversible photochromic effect).

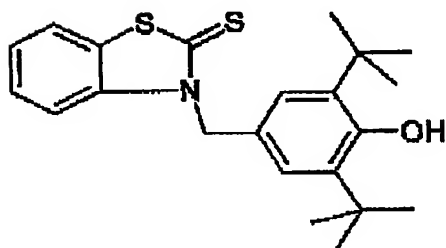
Thus, present invention relates to a method of coloring a polymeric material, wherein a polymeric material containing

- a) a phenolic antioxidant and/or phenolic UVA and
- b) a colour former

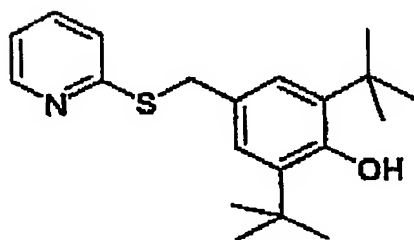
is irradiated using a radiation of higher energy than visible light, provided that the phenolic antioxidant and/or phenolic UVA (a) is not a compound of the formula (2) to (14)



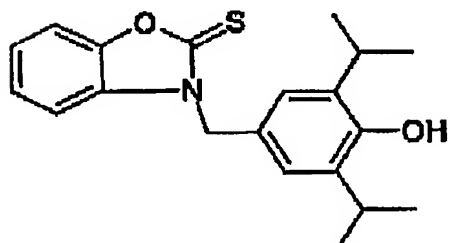
(2)



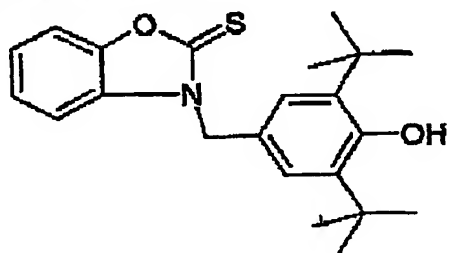
(3)



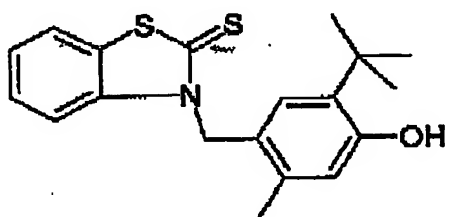
(4)



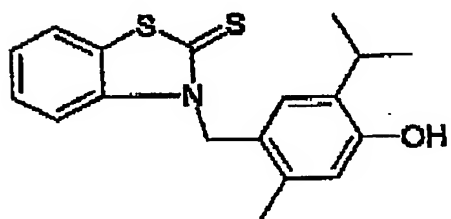
(5)



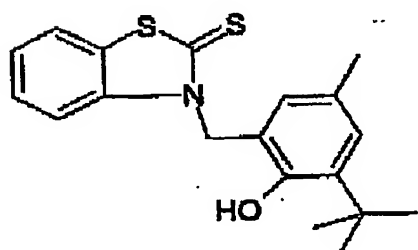
(6)



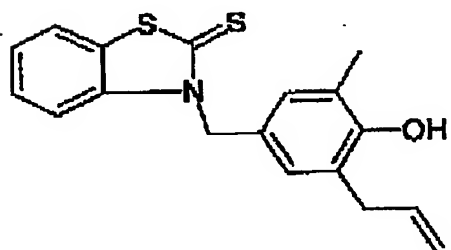
(7)



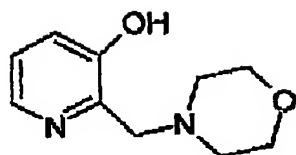
(8)



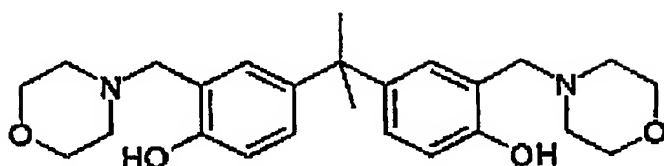
(9)



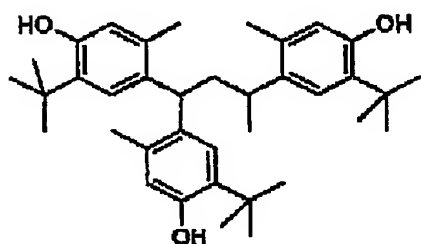
(10)



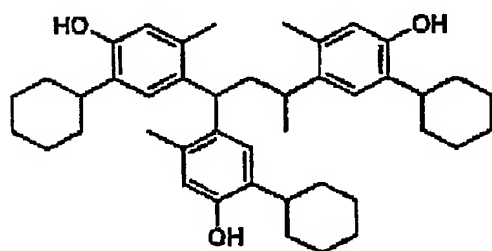
(11)



(12)



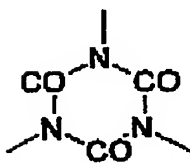
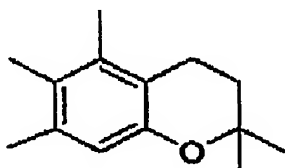
(13)

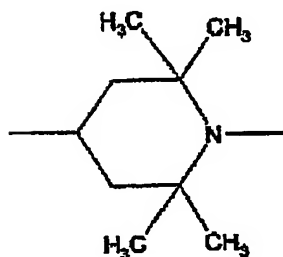


(14).

Suitable radiation includes UV light (wavelength (λ) shorter than 400 nm), X-ray, γ -ray, or particle radiation such as electron beam. Preferred radiation sources include UV laser, UV lamp, X-ray or electron radiation sources, radioactive materials emitting α -, β - and/or γ -radiation.

The phenolic antioxidant and/or phenolic UVA (a) is widely known for use in polymeric compositions, e.g. as a processing stabilizer or light stabilizer, and an item of commerce. The molecular weight of the phenolic antioxidant and/or phenolic UVA is preferably 340 g/mol or higher, e.g. from 340 to 1500 g/mol; in a specific embodiment ranging from 400 to 1300 g/mol.

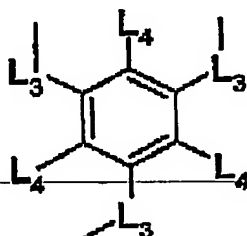
CN1C=NC2=C1N=CN2

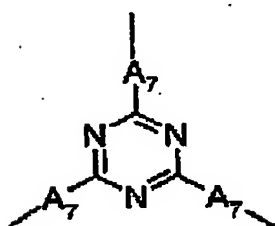
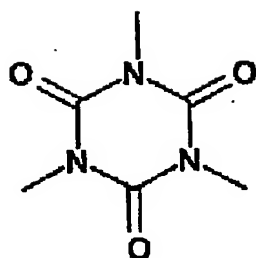


In an important phenolic antioxidant (a) to be used in the method of the invention, each mono-hydroxyphenyl moiety present usually contains one or two linking bonds to either a group connecting the moiety with 1 to 3 further moieties of the same type (linking group) or to an anchor group, and optionally 1-3 further substituents, e.g. alkyl of 1 to 12 carbon atoms.

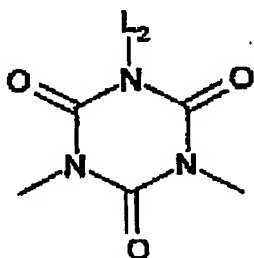
Preferred substituents on the mono-hydroxyphenyl moiety are methyl or tertiary C_4 - C_{12} alkyl, especially methyl, tert.-butyl and tert.-pentyl.

Linking groups are usually di-, tri- or tetravalent aliphatic groups of 1 to 20 carbon atoms, such as divalent groups selected from alkylene which may be interrupted and/or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, a group L_1 , phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy; divalent mono-, di- or tricycloalkylene groups; divalent mono-, di- or tricycloalkylene groups interrupted by $-O-$; spacer groups $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$; trivalent groups selected from trivalent alkyl groups of 3 to 20 carbon atoms; said trivalent alkyl groups interrupted and/or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, a group L_1 , phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy; or trivalent groups of the formulae

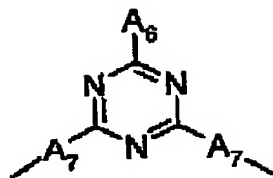




tetravalent alkyl groups of 4 to 20 carbon atoms; said tetravalent alkyl groups interrupted and/or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, a group L_1 , phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy;
 L_1 is a group selected from the formulae



- 8 -



L_2 is OH, C_1 - C_{12} alkyl, C_1 - C_{12} alkoxy, C_2 - C_{12} hydroxyalkyl; C_2 - C_{12} hydroxyalkoxy;

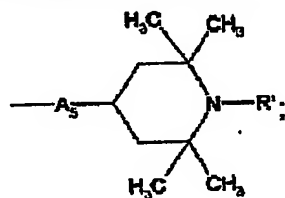
L_3 independently are C_1 - C_4 alkylene;

L_4 independently are H or C_1 - C_4 alkyl; and

A_6 and A_7 are as defined for anchor groups below.

Anchor groups are usually selected from

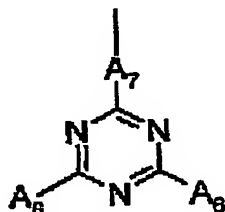
C_1 - C_{22} alkyl; C_1 - C_{22} alkyl- A_5 ; C_2 - C_{22} alkyl interrupted by $-A_5$; $-A_6$ -phenyl; $-A_6$ -phenyl where the phenyl core is substituted by C_1 - C_{12} alkyl, C_1 - C_{12} alkoxy, C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy; C_1 - C_8 alkyl substituted by a group of the formula



phosphite, phosphate or phosphonate ester groups, e.g. of the formula



or the anchor group is of the formula



where m and p independently are 0 or 1;

A₁ and A₂ independently are C₁-C₁₂alkyl or phenyl or phenyl substituted by C₁-C₁₂alkyl or an equivalent of an alkaline, alkaline earth or aluminum atom;

A₃ is a direct bond or C₁-C₈alkylene;

A₄ is selected from C₁-C₈alkylene and A₅;

A₅ is selected from -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-;

A₆ is selected from C₁-C₁₈alkoxy, C₁-C₁₈alkylthio and C₁-C₁₈alkylamino;

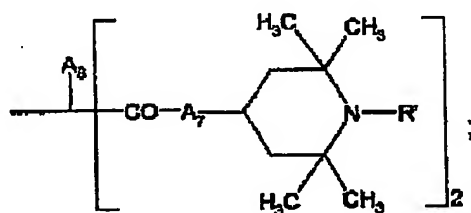
A₇ is -O- or -NH-;

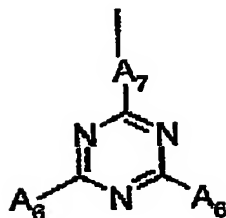
R' is H, C₁-C₁₈alkyl, C₁-C₁₈alkoxy or cyclohexyloxy;

or the anchor group is C₃-C₂₂alkylene or C₃-C₂₂oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-hydroxyphenyl moiety.

If the anchor group is attached to the phenol moiety by a carbon atom, this carbon atom is preferably quaternary carbon (i.e. carbon containing no bond to hydrogen).

Preferred anchor groups are tertiary C₄-C₁₂alkyl; C₁-C₂₂alkyl-A₅; C₂-C₂₂alkyl interrupted by -A₅; -A₅-phenyl; -A₅-phenyl where the phenyl core is substituted by C₁-C₁₂alkyl; -A₄-phenyl where the phenyl core is substituted by C₂-C₁₂alkanoyloxy and/or C₃-C₁₂alkenoyloxy, and optionally further by C₁-C₁₂alkyl; or the anchor group is C₃-C₂₂alkylene or C₃-C₂₂oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-hydroxyphenyl moiety; or is a group of one the formulae





where m and p independently are 0 or 1;

A_1 and A_2 independently are C_1 - C_{12} alkyl or phenyl or phenyl substituted by C_1 - C_{12} alkyl or an equivalent of an alkaline, alkaline earth or aluminum atom;

A_3 is a direct bond or C_1 - C_8 alkylene;

A_4 is selected from C_1 - C_8 alkylene, $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

A_5 is selected from $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

A_6 is selected from C_1 - C_{18} alkoxy, C_1 - C_{18} alkylthio and C_1 - C_{18} alkylamino;

A_7 is $-O-$ or $-NH-$;

A_8 is C_1 - C_7 alkyl;

R' is C_1 - C_{18} alkyl.

Anchor or linking groups often contain one or more spacers such as $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, phenylene, or substituted phenylene; these groups may be linked together, however, usually no $-O-O-$ (peroxo) or $-NH-O-$ or $-NH-S-$ or $-O-S-$ linkage is formed.

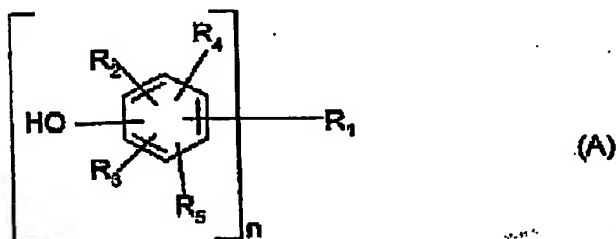
Alkylene groups end-capped by A_5 are, for example, $-alkylene-A_5-$, $-A_5-alkylene$, $-A_5-alkylene-A_5-$.

R' is preferably C_1 - C_{18} alkyl, especially methyl.

In phosphite, phosphate or phosphonate ester groups, A_1 and A_2 independently preferably are C_1 - C_{12} alkyl an equivalent of an alkaline, alkaline earth or aluminum atom.

Preferred salts are those wherein only one of A_1 and A_2 is an equivalent of a metal atom, e.g. selected from Li, Na, K, $\frac{1}{2}$ Mg, $\frac{1}{2}$ Ca, $\frac{1}{3}$ Al, especially $\frac{1}{2}$ Ca. More preferred are phosphates where p is 1, especially phosphonates where m is 0 and p is 1 or corresponding salts.

Thus, the phenolic antioxidant (a) is preferably of the formula (A)



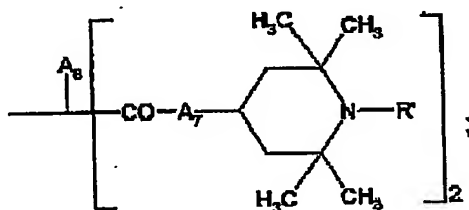
wherein

R_2 , R_3 , R_4 and R_5 independently are hydrogen, methyl or tertiary C_4 - C_{12} alkyl, especially methyl, tert.-butyl and tert.-pentyl;

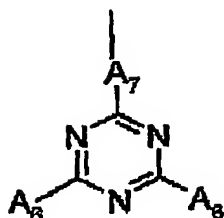
n is from the range 1-4;

when n is 1,

R_1 is tertiary C_4 - C_{12} alkyl; C_1 - C_{22} alkyl- A_5 ; C_2 - C_{22} alkyl interrupted by $-\text{A}_5$; $-\text{A}_5$ -phenyl; $-\text{A}_5$ -phenyl where the phenyl core is substituted by C_1 - C_{12} alkyl; $-\text{A}_4$ -phenyl where the phenyl core is substituted by C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy, and optionally further by C_1 - C_{12} alkyl; or R_1 together with R_5 is C_3 - C_{22} alkylene or C_3 - C_{22} oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-hydroxyphenyl moiety; or is a group of one the formulae



- 12 -



where m and p independently are 0 or 1;

A₁ and A₂ independently are C₁-C₁₂alkyl or phenyl or phenyl substituted by C₁-C₁₂alkyl or an equivalent of an alkaline, alkaline earth or aluminum atom;

A₃ is a direct bond or C₁-C₈alkylene;

A₄ is selected from C₁-C₈alkylene, -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-;

A₅ is selected from -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-;

A₆ is selected from C₁-C₁₈alkoxy, C₁-C₁₈alkylthio and C₁-C₁₈alkylamino;

A₇ is -O- or -NH-;

A₈ is C₁-C₇alkyl;

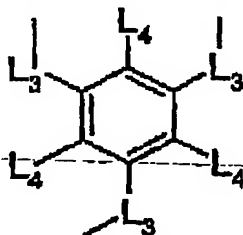
R' is C₁-C₁₈alkyl;

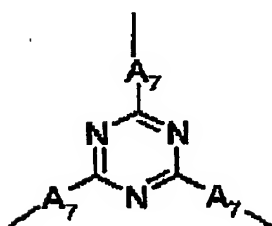
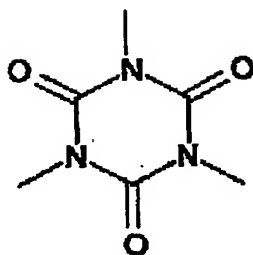
when n is 2, R₁ is C₁-C₂₀alkylene which may be interrupted and/or end-capped with -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-, -L₁-, phenylene, phenylene which is substituted by C₁-C₁₂alkyl and/or C₁-C₁₂alkoxy and/or C₂-C₁₂alkanoyloxy and/or C₃-

C₁₂alkenoyloxy;

divalent mono-, di- or tricycloalkylene groups; divalent mono-, di- or tricycloalkylene groups interrupted by -O-; spacer groups -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-;

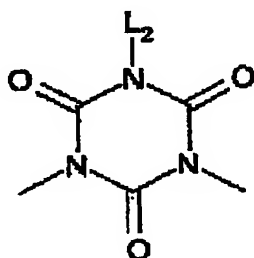
when n is 3, R₁ is trivalent alkyl of 3 to 20 carbon atoms; said trivalent alkyl interrupted or end-capped with -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-, -L₁-, phenylene, phenylene which is substituted by C₁-C₁₂alkyl and/or C₁-C₁₂alkoxy and/or C₂-C₁₂alkanoyloxy and/or C₃-C₁₂alkenoyloxy; or trivalent groups of the formulae

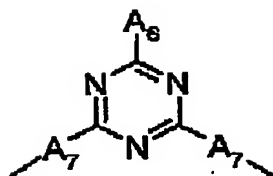




when n is 4, R_1 is tetravalent alkyl of 4 to 20 carbon atoms; said tetravalent alkyl interrupted or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, $-L_1-$, phenylene, phenylene which is substituted by C_1-C_{12} alkyl and/or C_1-C_{12} alkoxy and/or C_2-C_{12} alkanoyloxy and/or C_3-C_{12} alkenoyloxy;

L_1 is a group selected from the formulae





L_2 is OH, C_1 - C_{12} alkyl, C_1 - C_{12} alkoxy, C_2 - C_{12} hydroxyalkyl; C_2 - C_{12} hydroxyalkoxy;

L_3 independently are C_1 - C_4 alkylene;

L_4 independently are H or C_1 - C_4 alkyl.

Especially preferred are those wherein

R_2 , R_3 , R_4 and R_5 independently are hydrogen, methyl, tert.-butyl, tert.-pentyl;

when n is 1,

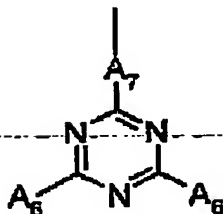
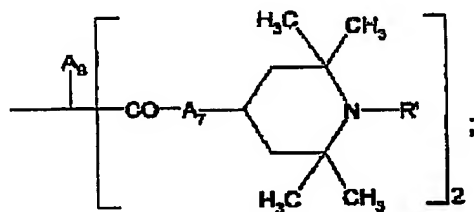
R_1 is tertiary butyl, tertiary pentyl; C_1 - C_{22} alkyl- A_5 ; C_2 - C_{22} alkyl interrupted by $-A_5$; $-A_5$ -phenyl

where the phenyl core is substituted by C_1 - C_{12} alkyl; $-A_4$ -phenyl where the phenyl core is

substituted by C_3 - C_4 alkenoyloxy and C_1 - C_{12} alkyl; or R_1 together with R_6 is C_3 - C_{22} alkylene or

C_3 - C_{22} oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-

hydroxyphenyl moiety; or R_1 is a group of one the formulae



A₁ and A₂ independently are C₁-C₄alkyl or an equivalent of a metal atom selected from Li, Na, K, ½ Mg, ½ Ca, 1/3 Al;

A₃ is methylene;

A₄ is C₁-C₈alkylene;

A₅ is selected from -O-, -S-, -COO-, -OCO-, -NHCO-, -CONH-;

A₆ is selected from C₄-C₁₈alkylthio and C₄-C₁₈alkylamino;

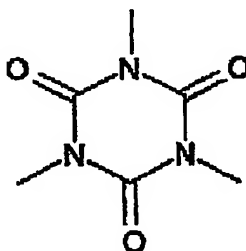
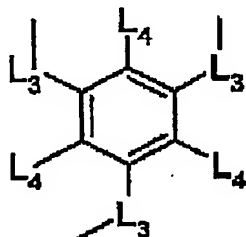
A₇ is -NH-;

A₈ is C₁-C₇alkyl;

R' is C₁-C₁₈alkyl;

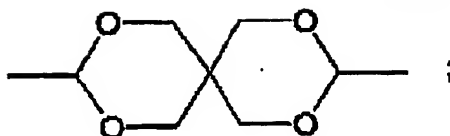
when n is 2, R₁ is C₁-C₁₂alkylene; C₂-C₂₀alkylene interrupted and/or end-capped with -O-, -S-, -COO-, -OCO-, -NHCO-, -CONH-, -L₁-; or R₁ is a divalent mono-, di- or tricycloalkylene group; or R₁ is -O-, -NH-, -S-;

when n is 3, R₁ is trivalent alkyl of 3 to 20 carbon atoms; said trivalent alkyl interrupted by -O-, -S-, -COO-, -OCO-, -NHCO-, -CONH-, phenylene, phenylene which is substituted by C₁-C₁₂alkyl; or R₁ is a trivalent group of one of the formulae



when n is 4, R₁ is tetravalent alkyl of 4 to 20 carbon atoms; or said tetravalent alkyl interrupted by -O-, -S-, -COO-, -OCO-, -NHCO-, -CONH-;

L₁ is a group of the formula

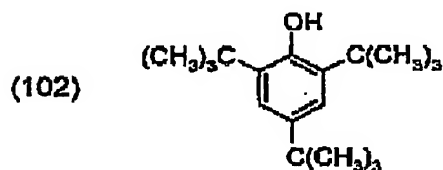
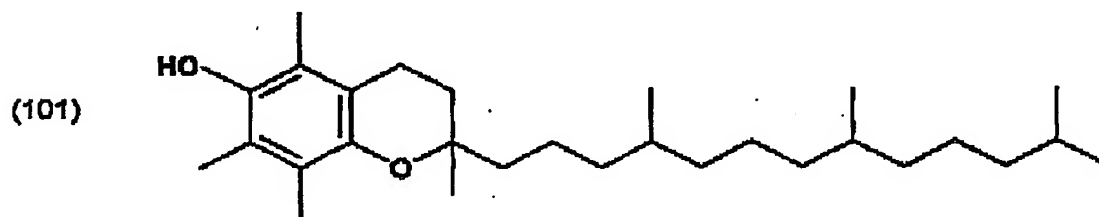


L₃ independently are C₁-C₄alkylene;

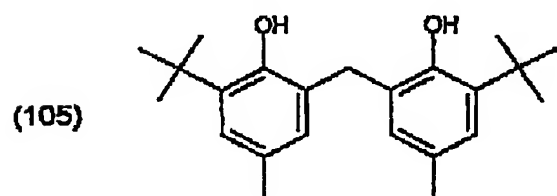
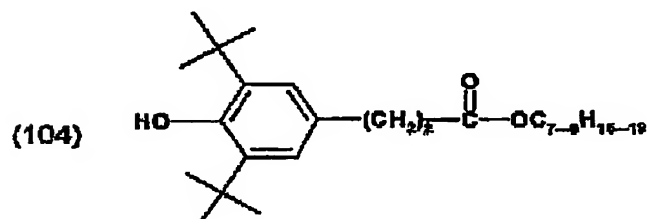
L₄ independently are H or C₁-C₄alkyl.

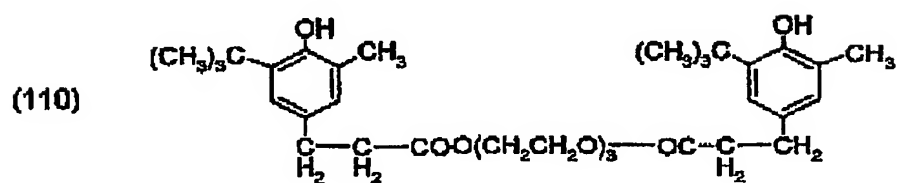
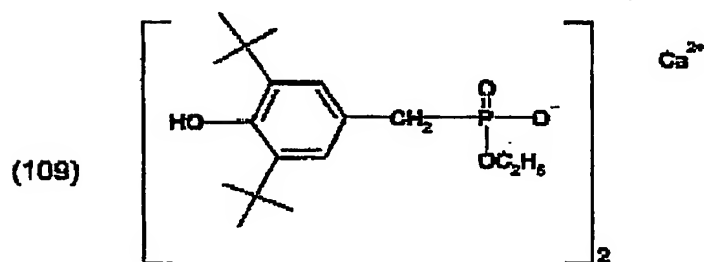
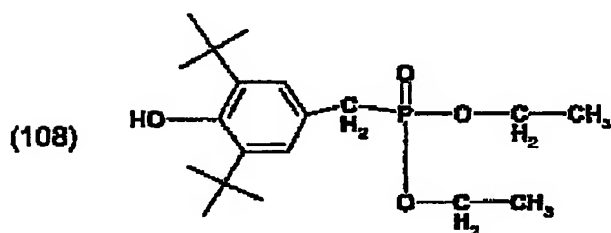
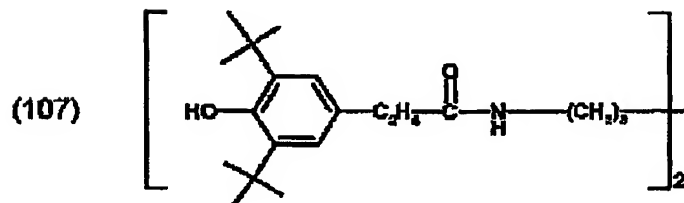
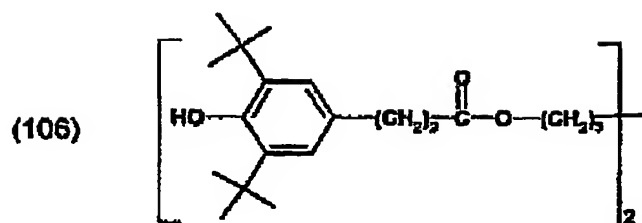
In particularly preferred phenolic antioxidants, each mono-hydroxyphenyl moiety contains one or preferably two aliphatic substituents, e.g. methyl, tert.-butyl, tert.-pentyl, at least one thereof being located in ortho-position relative to the phenolic OH.

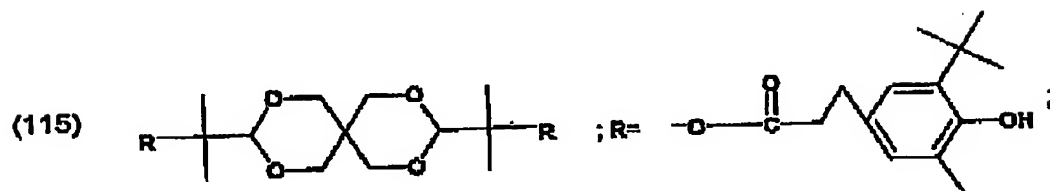
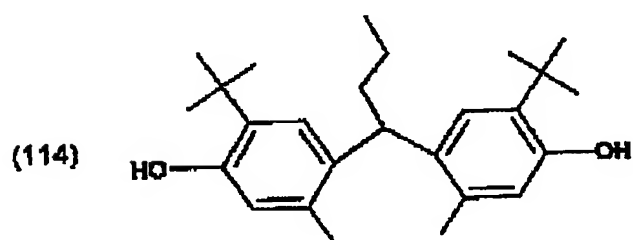
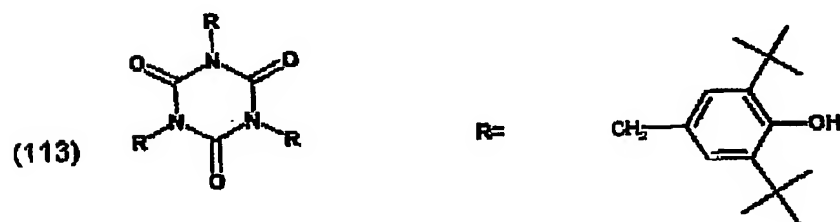
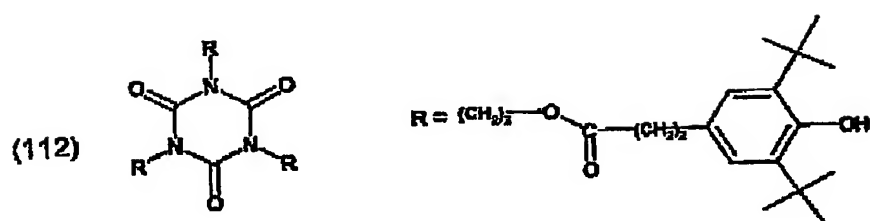
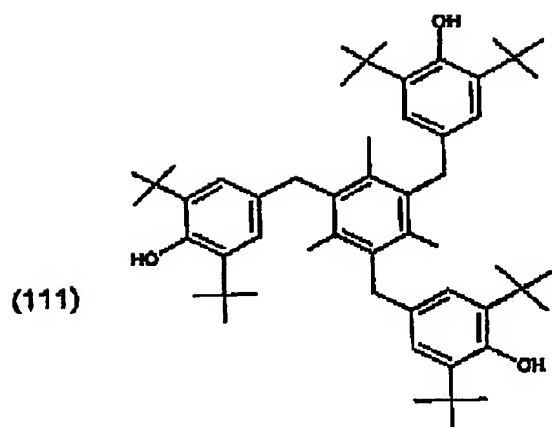
Phenolic antioxidants useful in the present invention include the compounds listed below:

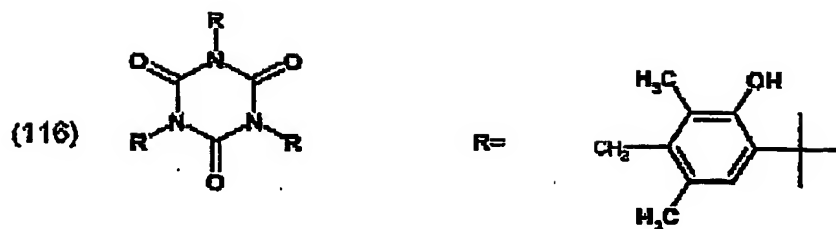


(103) octadecyl-3-[3',5'-di-tert.butyl-4'-hydroxyphenyl] propionate

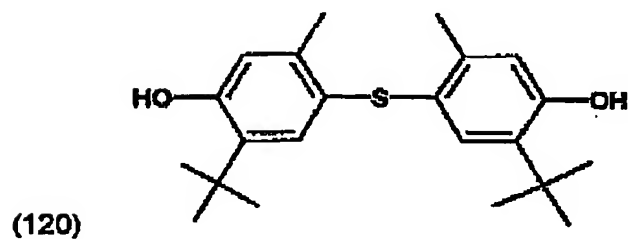
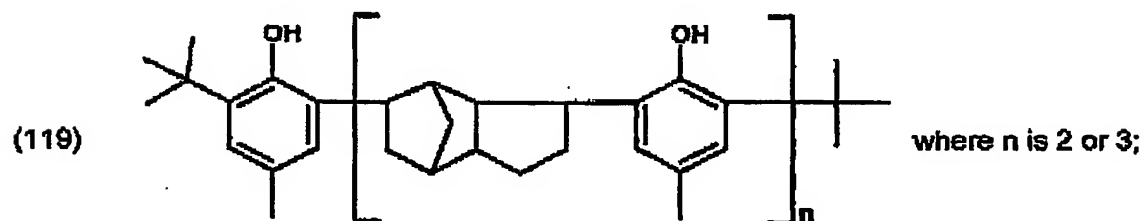
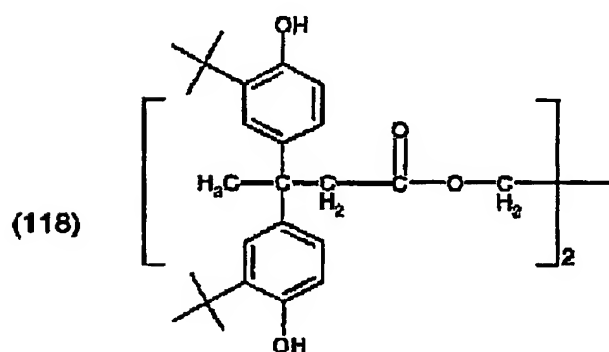


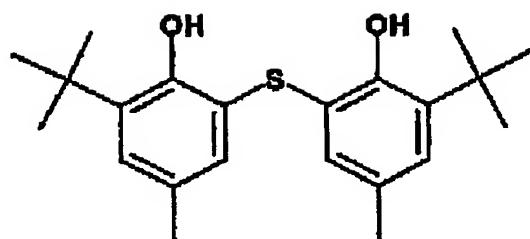




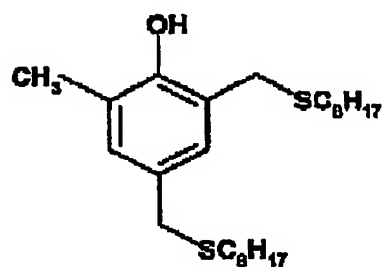


- (117) pentaerythritol-tetrakis(3-[3',5'-di-tert.butyl-4'-hydroxyphenyl]-propionate)
(CAS Reg.-No. 006683-19-8)

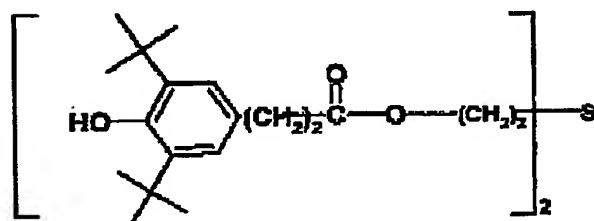




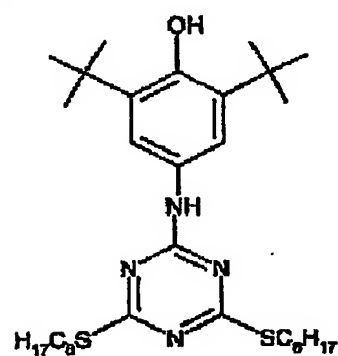
(121)



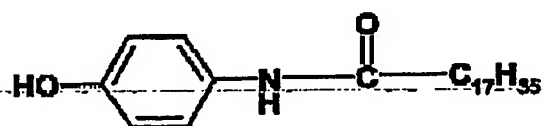
(122)



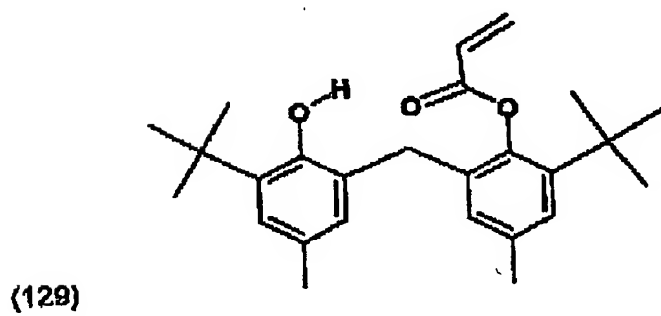
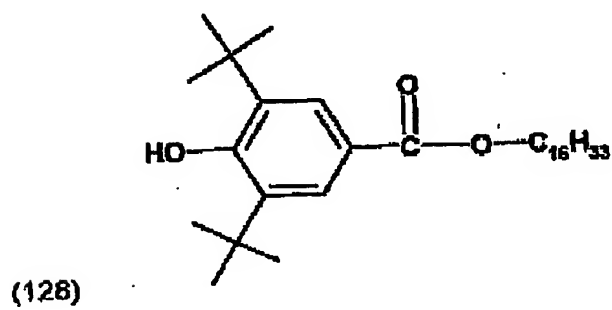
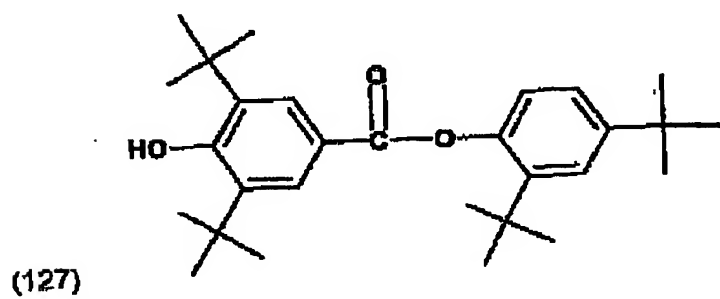
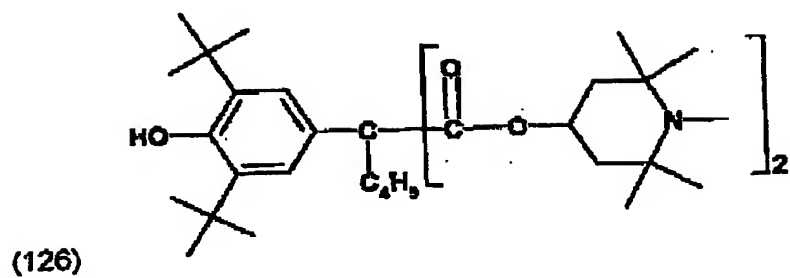
(123)

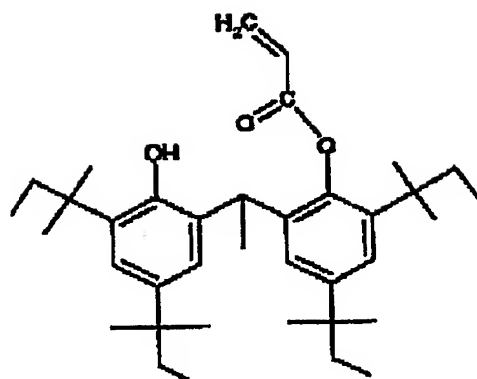


(124)

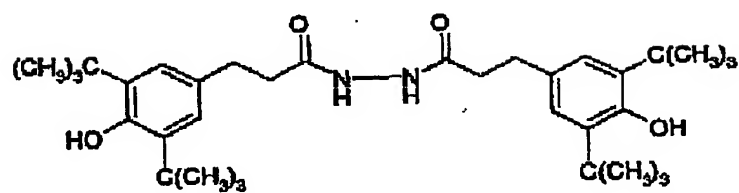


(125) (125)

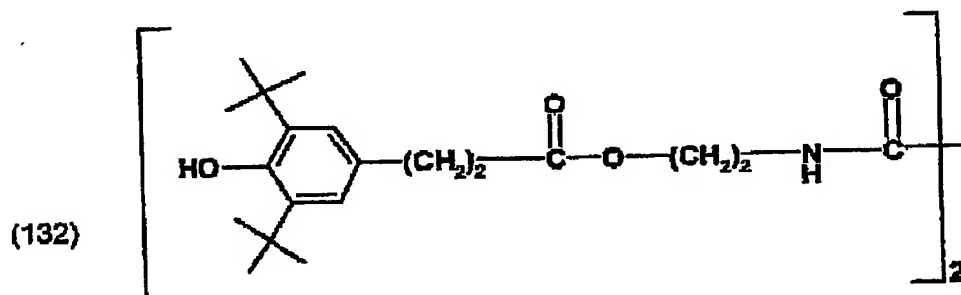




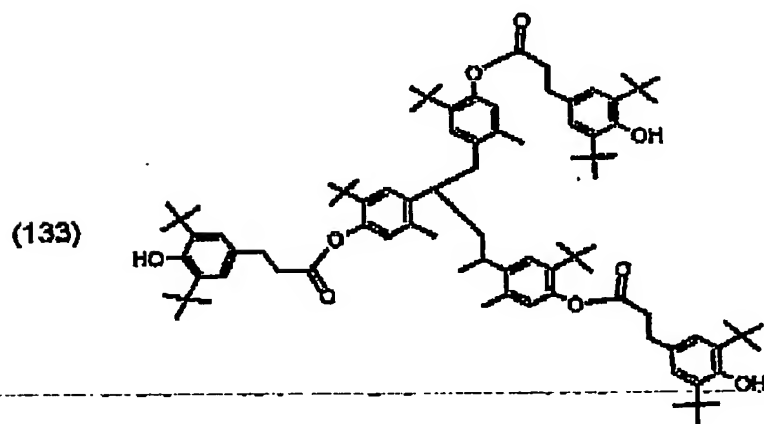
(130)



(131)



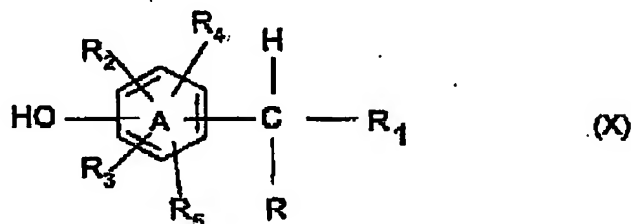
(132)



(133)

(134)

The phenolic antioxidant and/or phenolic UVA (a) is preferably not of the formula



wherein ring A can contain one or more hetero atoms and/or can contain an anelated ring, R₁ is hydrogen, alkyl, alkenyl, aryl,

R₂, R₃, R₄ and R₅ independently of each other are hydrogen or a functional substituent, and R stands for C₁-C₈alkyl, -Z₁-Q₁, or -Z₂-Q₂,

wherein Z₁ is a single bond, S, NH or O, and Q₁ is a heterocyclic ring system having from 5 to 9 ring atoms selected from C, S, O and N, with at least 2 carbon atoms in the ring system, preferably Q₁ stands for morpholine, pyridine, which may be substituted one to three times with C₁-C₄alkyl or hydroxy, mercaptobenzoxazole, mercaptobenzthiazole,

and wherein Z₂ stands for C₁-C₄alkylene, which can be substituted by C₁-C₄alkyl or Q₃,

wherein Q₃ stands for phenyl which can be substituted one to three times with C₁-C₄alkyl, hydroxy, C₅-C₈cycloalkyl and/or a heterocyclic ring system having from 5 to 9 ring atoms selected from C, S, O and N, with at least 2 carbon atoms in the ring system, and Q₂ stands for phenyl which can be substituted one to three times with C₁-C₄alkyl, hydroxy, C₅-C₈cycloalkyl and/or a heterocyclic ring system having from 5 to 9 ring atoms selected from C, S, O and N, with at least 2 carbon atoms in the ring system, such as compounds of the formula X wherein the H at the C-atom in α-position to R can be split off by irradiation.

Halogen means fluoro, chloro, bromo, or iodo, preferably chloro.

It is furthermore preferred that at least one of R₂ and R₃ is in o-position to the OH-group.

C₁-C₂₂-alkyl means, for example, methyl, ethyl, n-, i-propyl, n-, sec-, iso-, tert.-butyl, n-pentyl, tert.-pentyl, n-hexyl, n-heptyl, n-octyl, tert.-octyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, n-tridecyl, n-tetradecyl, n-pentadecyl, n-hexadecyl, n-heptadecyl, n-octadecyl, n-nonadecyl, n-eicosyl.

C_2 - C_{20} -alkenyl stands for e.g. ethenyl, n-, i-propenyl, n-, sec-, iso-, tert.-butenyl, n-pentenyl, n-hexenyl, n-heptenyl, n-octenyl, n-nonenyl, n-decenyl, n-undecenyl, n-dodecenyl, n-tridecenyl, n-tetradecenyl, n-pentadecenyl, n-hexadecenyl, n-heptadecenyl, n-octadecenyl, n-nonadecenyl, n-eicosenyl, preferably C_2 - C_8 -alkyl such as ethenyl, n-, i-propenyl, n-, sec-, iso-, tert.-butenyl, n-pentenyl, n-hexenyl.

C_5 - C_8 -cycloalkyl stands for cyclopentyl, cyclohexyl, cycloheptyl, or cyclooctyl, preferably

cyclohexyl. Examples for di- or tricycloalkyl groups are bicycloheptyl or



Di-, tri- or tetravalent residues may be derived from the corresponding monovalent units, e.g. those listed above, by abstraction of 1, 2 or 3 further hydrogen atoms.

C_1 - C_6 -alkoxy stands for e.g. methoxy, ethoxy, n-, i-propoxy, n-, sec-, iso-, tert.-butoxy, n-pentoxy, n-hexoxy.

C_2 - C_{12} -alkanoyloxy includes, for example acetyloxy, propionyloxy; C_3 - C_{12} -alkenoyloxy includes acryloyloxy, methacryloyloxy.

Polymeric material useable for the present invention is preferably synthetic organic polymeric material, for example material commonly used for electronic applications.

In particular the following polymers are preferred:

1. Polymers of monoolefins and diolefins, for example polypropylene, polyisobutylene, polybut-1-ene, poly-4-methylpent-1-ene, polyvinylcyclohexane, polyisoprene or polybutadiene, as well as polymers of cycloolefins, for instance of cyclopentene or norbornene, polyethylene (which optionally can be crosslinked), for example high density polyethylene (HDPE), high density and high molecular weight polyethylene (HDPE-HMW), high density and ultra-high molecular weight polyethylene (HDPE-UHMW), medium density polyethylene (MDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), (VLDPE) and (ULDPE).

Polyolefins, i.e. the polymers of monoolefins exemplified in the preceding paragraph, preferably polyethylene and polypropylene, can be prepared by different, and especially by the following, methods:

- a) radical polymerisation (normally under high pressure and at elevated temperature).
 - b) catalytic polymerisation using a catalyst that normally contains one or more than one metal of groups IVb, Vb, Vlb or VIII of the Periodic Table. These metals usually have one or more than one ligand, typically oxides, halides, alcoholates, esters, ethers, amines, alkyls, alkenyls and/or aryls that may be either π - or σ -coordinated. These metal complexes may be in the free form or fixed on substrates, typically on activated magnesium chloride, titanium(III) chloride, alumina or silicon oxide. These catalysts may be soluble or insoluble in the polymerisation medium. The catalysts can be used by themselves in the polymerisation or further activators may be used, typically metal alkyls, metal hydrides, metal alkyl halides, metal alkyl oxides or metal alkyloxanes, said metals being elements of groups Ia, IIa and/or IIIa of the Periodic Table. The activators may be modified conveniently with further ester, ether, amine or silyl ether groups. These catalyst systems are usually termed Phillips, Standard Oil Indiana, Ziegler (-Natta), TNZ (DuPont), metallocene or single site catalysts (SSC).
2. Mixtures of the polymers mentioned under 1), for example mixtures of polypropylene with polyisobutylene, polypropylene with polyethylene (for example PP/HDPE, PP/LDPE) and mixtures of different types of polyethylene (for example LDPE/HDPE).
 3. Copolymers of monoolefins and diolefins with each other or with other vinyl monomers, for example ethylene/propylene copolymers, linear low density polyethylene (LLDPE) and mixtures thereof with low density polyethylene (LDPE), propylene/but-1-ene copolymers, propylene/isobutylene copolymers, ethylene/but-1-ene copolymers, ethylene/hexene copolymers, ethylene/methylpentene copolymers, ethylene/heptene copolymers, ethylene/octene copolymers, ethylene/vinylcyclohexane copolymers, ethylene/cycloolefin copolymers (e.g. ethylene/norbornene like COC), ethylene/1-olefins copolymers, where the 1-olefin is generated in-situ; propylene/butadiene copolymers, isobutylene/isoprene copolymers, ethylene/vinylcyclohexene copolymers, ethylene/alkyl acrylate copolymers, ethyl-

ene/alkyl methacrylate copolymers, ethylene/vinyl acetate copolymers or ethylene/acrylic acid copolymers and their salts (ionomers) as well as terpolymers of ethylene with propylene and a diene such as hexadiene, dicyclopentadiene or ethylidene-norbornene; and mixtures of such copolymers with one another and with polymers mentioned in 1) above, for example polypropylene/ethylene-propylene copolymers, LDPE/ethylene-vinyl acetate copolymers (EVA), LDPE/ethylene-acrylic acid copolymers (EAA), LLDPE/EVA, LLDPE/EAA and alternating or random polyalkylene/carbon monoxide copolymers and mixtures thereof with other polymers, for example polyamides.

4. Hydrocarbon resins (for example C_5-C_{10}) including hydrogenated modifications thereof (e.g. tackifiers) and mixtures of polyalkylenes and starch.

Homopolymers and copolymers from 1.) - 4.) may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

5. Polystyrene, poly(p-methylstyrene), poly(α -methylstyrene).

6. Aromatic homopolymers and copolymers derived from vinyl aromatic monomers including styrene, α -methylstyrene, all isomers of vinyl toluene, especially p-vinyltoluene, all isomers of ethyl styrene, propyl styrene, vinyl biphenyl, vinyl naphthalene, and vinyl anthracene, and mixtures thereof. Homopolymers and copolymers may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

6a. Copolymers including aforementioned vinyl aromatic monomers and comonomers selected from ethylene, propylene, dienes, nitriles, acids, maleic anhydrides, maleimides, vinyl acetate and vinyl chloride or acrylic derivatives and mixtures thereof, for example styrene/butadiene, styrene/acrylonitrile, styrene/ethylene (interpolymers), styrene/alkyl methacrylate, styrene/butadiene/alkyl acrylate, styrene/butadiene/alkyl methacrylate, styrene/maleic anhydride, styrene/acrylonitrile/methyl acrylate; mixtures of high impact strength of styrene copolymers and another polymer, for example a polyacrylate, a diene polymer or an ethylene/propylene/diene terpolymer; and block copolymers of styrene such as sty-

rene/butadiene/styrene, styrene/isoprene/styrene, styrene/ethylene/butylene/styrene or styrene/ethylene/propylene/styrene.

6b. Hydrogenated aromatic polymers derived from hydrogenation of polymers mentioned under 6.), especially including polycyclohexylethylene (PCHE) prepared by hydrogenating atactic polystyrene, often referred to as polyvinylcyclohexane (PVCH).

6c. Hydrogenated aromatic polymers derived from hydrogenation of polymers mentioned under 6a.).

Homopolymers and copolymers may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

7. Graft copolymers of vinyl aromatic monomers such as styrene or α -methylstyrene, for example styrene on polybutadiene, styrene on polybutadiene-styrene or polybutadiene-acrylonitrile copolymers; styrene and acrylonitrile (or methacrylonitrile) on polybutadiene; styrene, acrylonitrile and methyl methacrylate on polybutadiene; styrene and maleic anhydride on polybutadiene; styrene, acrylonitrile and maleic anhydride or maleimide on polybutadiene; styrene and maleimide on polybutadiene; styrene and alkyl acrylates or methacrylates on polybutadiene; styrene and acrylonitrile on ethylene/propylene/diene terpolymers; styrene and acrylonitrile on polyalkyl acrylates or polyalkyl methacrylates, styrene and acrylonitrile on acrylate/butadiene copolymers, as well as mixtures thereof with the copolymers listed under 6), for example the copolymer mixtures known as ABS, MBS, ASA or AES polymers.

8. Halogen-containing polymers such as polychloroprene, chlorinated rubbers, chlorinated and brominated copolymer of isobutylene-isoprene (halobutyl rubber), chlorinated or sulfochlorinated polyethylene, copolymers of ethylene and chlorinated ethylene, epichlorohydrin homo- and copolymers, especially polymers of halogen-containing vinyl compounds, for example polyvinyl chloride, polyvinylidene chloride, polyvinyl fluoride, polyvinylidene fluoride, as well as copolymers thereof such as vinyl chloride/vinylidene chloride, vinyl chloride/vinyl acetate or vinylidene chloride/vinyl acetate copolymers.

9. Polymers derived from α,β -unsaturated acids and derivatives thereof such as polyacrylates and polymethacrylates; polymethyl methacrylates, polyacrylamides and polyacrylonitriles, impact-modified with butyl acrylate.

10. Copolymers of the monomers mentioned under 9) with each other or with other unsaturated monomers, for example acrylonitrile/ butadiene copolymers, acrylonitrile/alkyl acrylate copolymers, acrylonitrile/alkoxyalkyl acrylate or acrylonitrile/vinyl halide copolymers or acrylonitrile/ alkyl methacrylate/butadiene terpolymers.

11. Polymers derived from unsaturated alcohols and amines or the acyl derivatives or acetals thereof, for example polyvinyl alcohol, polyvinyl acetate, polyvinyl stearate, polyvinyl benzoate, polyvinyl maleate, polyvinyl butyral, polyallyl phthalate or polyallyl melamine; as well as their copolymers with olefins mentioned in 1) above.

12. Homopolymers and copolymers of cyclic ethers such as polyalkylene glycols, polyethylene oxide, polypropylene oxide or copolymers thereof with bisglycidyl ethers.

13. Polyacetals such as polyoxymethylene and those polyoxymethylenes, which contain ethylene oxide as a comonomer, polyacetals modified with thermoplastic polyurethanes, acrylates or MBS.

14. Polyphenylene oxides and sulfides, and mixtures of polyphenylene oxides with styrene polymers or polyamides.

15. Polyurethanes derived from hydroxyl-terminated polyethers, polyesters or polybutadienes on the one hand and aliphatic or aromatic polyisocyanates on the other, as well as precursors thereof.

16. Polyamides and copolyamides derived from diamines and dicarboxylic acids and/or from aminocarboxylic acids or the corresponding lactams, for example polyamide 4, polyamide 6, polyamide 6/6, 6/10, 6/9, 6/12, 4/6, 12/12, polyamide 11, polyamide 12, aromatic polyamides starting from m-xylene diamine and adipic acid; polyamides prepared from hexamethylenediamine and isophthalic or/and terephthalic acid and with or without an elastomer as modifier, for example poly-2,4,4'-trimethylhexamethylene terephthalamide or po-

ly-m-phenylene isophthalamide; and also block copolymers of the aforementioned polyamides with polyolefins, olefin copolymers, ionomers or chemically bonded or grafted elastomers; or with polyethers, e.g. with polyethylene glycol, polypropylene glycol or polytetramethylene glycol; as well as polyamides or copolyamides modified with EPDM or ABS; and polyamides condensed during processing (RIM polyamide systems).

17. Polyureas, polyimides, polyamide-imides, polyetherimids, polyesterimids, polyhydantoins and polybenzimidazoles.

18. Polyesters derived from dicarboxylic acids and diols and/or from hydroxycarboxylic acids or the corresponding lactones, for example polyethylene terephthalate, polybutylene terephthalate, poly-1,4-dimethylolcyclohexane terephthalate, polyalkylene naphthalate (PAN) and polyhydroxybenzoates, as well as block copolyether esters derived from hydroxyl-terminated polyethers; and also polyesters modified with polycarbonates or MBS.

19. Polycarbonates and polyester carbonates.

20. Polyketones.

21. Polysulfones, polyether sulfones and polyether ketones.

22. Crosslinked polymers derived from aldehydes on the one hand and phenols, ureas and melamines on the other hand, such as phenol/formaldehyde resins, urea/formaldehyde resins and melamine/formaldehyde resins.

23. Drying and non-drying alkyd resins.

24. Unsaturated polyester resins derived from copolyesters of saturated and unsaturated dicarboxylic acids with polyhydric alcohols and vinyl compounds as crosslinking agents, and also halogen-containing modifications thereof of low flammability.

25. Crosslinkable acrylic resins derived from substituted acrylates, for example epoxy acrylates, urethane acrylates or polyester acrylates.

26. Alkyd resins, polyester resins and acrylate resins crosslinked with melamine resins, urea resins, isocyanates, isocyanurates, polyisocyanates or epoxy resins.

27. Crosslinked epoxy resins derived from aliphatic, cycloaliphatic, heterocyclic or aromatic glycidyl compounds, e.g. products of diglycidyl ethers of bisphenol A and bisphenol F, which are crosslinked with customary hardeners such as anhydrides or amines, with or without accelerators.

28. Natural polymers such as cellulose, rubber, gelatin and chemically modified homologous derivatives thereof, for example cellulose acetates, cellulose propionates and cellulose butyrates, or the cellulose ethers such as methyl cellulose; as well as rosins and their derivatives.

29. Blends of the aforementioned polymers (polyblends), for example PP/EPDM, Polyamide/EPDM or ABS, PVC/EVA, PVC/ABS, PVC/MBS, PC/ABS, PBTP/ABS, PC/ASA, PC/PBT, PVC/CPE, PVC/acrylates, POM/thermoplastic PUR, PC/thermoplastic PUR, POM/acrylate, POM/MBS, PPO/HIPS, PPO/PA 6.6 and copolymers, PA/HDPE, PA/PP, PA/PPO, PBT/PC/ABS or PBT/PET/PC.

Preferred organic polymeric materials are synthetic thermoplastic materials, especially transparent ones.

Especially preferred is organic polymeric material made of SAN (copolymer made of styrene and acrylonitrile), polyolefin such as PP (polypropylene) or PE (polyethylene), PVC (polyvinylchloride), polychlorobutadiene, polyesters such as PET (polyethyleneterephthalate), PET-G (glycol modified PET), PMMA (polymethylmethacrylate) and related polyacrylics, PS (polystyrene), ASA (copolymer made of acrylonitrile, styrene, acrylate), PA (polyamide), ABS (copolymer made of acrylonitrile, styrene, butadiene), LLDPE (linear LDPE), LDPE (low density polyethylene), HDPE (high density polyethylene) and polycarbonate, most preferably polycarbonate. The polymeric material can also be a mixture (blend) of two or more polymers, e.g. polyester or PET-G/polycarbonate blends. Most preferred are transparent articles made from polycarbonate, polyester, PET-G, polyester or PET-G blends with polycarbonate, PVC, PE, PP, polyacrylics, polystyrene, such as films or sheets of these polymers or blends or alloys thereof.

The colour forming compounds are, for example, triphenylmethanes, lactones, benzoxazines, spiropyrans or preferably fluorans or phthalides.

Suitable colour formers include but are not limited to: 3-dibutylamino-7-dibenzylaminofluoran, 3-diethylamino-6-methylfluoran, 3-dimethylamino-6-methyl-7-anilinofluoran, 3-diethylamino-6-methyl-7-anilinofluoran, 3-diethylamino-6-methyl-7-(2,4-dimethylanilino) fluoran, 3-diethylamino-6-methyl-7-chlorofluoran, 3-diethylamino-6-methyl-7-(3-trifluoromethylanilino) fluoran, 3-diethylamino-6-methyl-7-(2-chloroanilino) fluoran, 3-diethylamino-6-methyl-7-(4-chloroanilino) fluoran, 3-diethylamino-6-methyl-7-(2-fluoroanilino) fluoran, 3-diethylamino-6-methyl-7-(4-n-octylanilino) fluoran, 3-diethylamino-7-(4-n-octylanilino) fluoran, 3-diethylamino-7-(4-n-octylamino) fluoran, 3-diethylamino-6-methyl-7-(dibenzylamino) fluoran, 3-diethylamino-7-(dibenzylamino) fluoran, 3-diethylamino-6-chloro-7-methylfluoran, 3-diethylamino-7-t-butylfluoran, 3-diethylamino-7-carboxyethylfluoran, 3-diethylamino-6-chloro-7-anilinofluoran, 3-diethylamino-6-methyl-7-(3-methylanilino) fluoran, 3-diethylamino-6-methyl-7-(4-methylanilino) fluoran, 3-diethylamino-6-ethoxyethyl-7-anilinofluoran, 3-diethylamino-7-methylfluoran, 3-diethylamino-7-chlorofluoran, 3-diethylamino-7-(3-trifluoromethylanilino) fluoran, 3-diethylamino-7-(2-chloroanilino) fluoran, 3-diethylamino-7-(2-fluoroanilino) fluoran, 3-diethylamino-benzo[a]fluoran, 3-diethylamino-benzo[c]fluoran, 3-dibutylamino-6-methyl fluoran, 3-dibutylamino-6-methyl-7-anilinofluoran, 3-dibutylamino-6-methyl-7-(2,4-dimethylanilino) fluoran, 3-dibutylamino-6-methyl-7-(2-chloroanilino) fluoran, 3-dibutylamino-6-methyl-7-(4-chloroanilino) fluoran, 3-dibutylamino-6-methyl-7-(2-fluoroanilino) fluoran, 3-dibutylamino-6-methyl-7-(3-trifluoromethylanilino) fluoran, 3-dibutylamino-6-ethoxyethyl-7-anilinofluoran, 3-dibutylamino-6-chloro-anilinofluoran, 3-dibutylamino-6-methyl-7-(4-methylanilino) fluoran, 3-dibutylamino-7-(2-chloroanilino) fluoran, 3-dibutylamino-7-(2-fluoroanilino) fluoran, 3-dipentylamino-6-methyl-7-anilinofluoran, 3-dipentylamino-6-methyl-7-(4-2-chloroanilino) fluoran, 3-dipentylamino-7-(3-trifluoromethylanilino) fluoran, 3-dipentylamino-6-chloro-7-anilinofluoran, 3-dipentylamino-7-(4-chloroanilino) fluoran, 3-pyrrolidino-6-methyl-7-anilinofluoran, 3-piperidino-6-methyl-7-anilinofluoran, 3-(N-methyl-N-propylamino)-6-methyl-7-anilinofluoran, 3-(N-methyl-N-cyclohexylamino)-6-methyl-7-anilinofluoran, 3-(N-ethyl-N-cyclohexylamino)-6-methyl-7-anilinofluoran, 3-(N-ethyl-p-toluidino)-6-methyl-7-anilinofluoran, 3-(N-ethyl-N-isoamylamino)-6-methyl-7-anilinofluoran, 3-(N-ethyl-N-isoamylamino)-6-chloro-7-anilinofluoran, 3-(N-ethyl-N-tetrahydrofurfurylamino)-6-methyl-7-anilinofluoran, 3-(N-ethyl-

N-isobutylamino)-6-methyl-7-anilino-fluoran, 3-(N-butyl-N-isoamylamino)-6-methyl-7-anilino-fluoran, 3-(N-isopropyl-N-3-pentylamino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-N-ethoxypropylamino)-6-methyl-7-anilino-fluoran, 3-cyclohexylamino-6-chloro-fluoran, 2-methyl-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 2-methoxy-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 2-chloro-3-methyl-6-p-(p-phenylaminophenyl)aminoanilino-fluoran, 2-diethylamino-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 2-phenyl-6-methyl-6-p-(p-phenylaminophenyl)aminoanilino-fluoran, 2-benzyl-6-p-(p-phenylaminophenyl)aminoanilino-fluoran, 3-methyl-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 3-diethylamino-6-p-(p-diethylaminophenyl)aminoanilino-fluoran, 3-diethylamino-6-p-(p-dibutylaminophenyl)aminoanilino-fluoran, 2,4-dimethyl-6-[(4-dimethylamino)anilino] fluoran, 3,6,6'-tris(dimethylamino)spiro[fluorene-9,3'-phthalide], 3,6,6'-tris(diethylamino)spiro[fluorene-9,3'-phthalide], 3,3-bis(p-dimethylaminophenyl)-6-dimethylaminophthalide, 3,3-bis(p-dimethylaminophenyl)phthalide, 3,3-bis-[2-(p-dimethylaminophenyl)-2-(p-methoxyphenyl)ethenyl-4,5,6,7-tetrabromophthalide, 3,3-bis-[2-(p-dimethylaminophenyl)-2-(p-methoxyphenyl)ethenyl-4,5,6,7-tetrachlorophthalide, 3,3-bis[1,1-bis(4-pyrrolidinophenyl)ethylene-2-yl]-4,5,6,7-tetrabromophthalide, 3,3-bis-[1-(4-methoxyphenyl)-1-(4-pyridinophenyl)ethylene-2-yl]-4,5,6,7-tetrachlorophthalide, 3-(4-diethylamino-2-ethoxyphenyl)-3-(1-ethyl-2-methylindole-3-yl)-4-azaphthalide, 3-(4-diethylamino-2-ethoxyphenyl)-3-(1-octyl-2-methylindole-3-yl)-4-azaphthaliden, 3-(4-cyclohexylethylamino-2-methoxyphenyl)-3-(1-ethyl-2-methylindole-3-yl)-4-azaphthalide, 3,3-bis(1-ethyl-2-methylindole-3-yl) phthalide, 3,3-bis(1-octyl-2-methylindole-3-yl) phthalide, mixture of 2-phenyl-4-(4-diethylaminophenyl)-4-(4-methoxyphenyl)-6-methyl-7-dimethylamino-3,1-benzoxazine and 2-phenyl-4-(4-diethylaminophenyl)-4-(4-methoxyphenyl)-8-methyl-7-dimethylamino-3,1-benzoxazine, 4,4'-[1-methylethylidene]bis(4,1-phenyleneoxy-4,2-quinazolinediyl)]bis[N,N-diethylbenzenamine], bis(N-methyldiphenylamine)-4-yl-(N-butylcarbazole)-3-yl-methane.

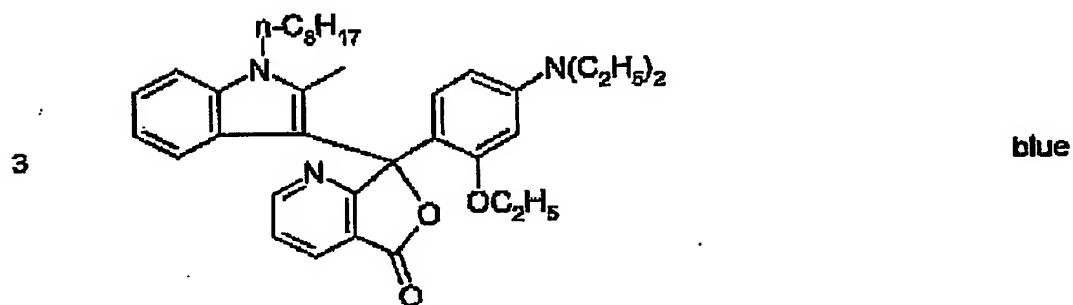
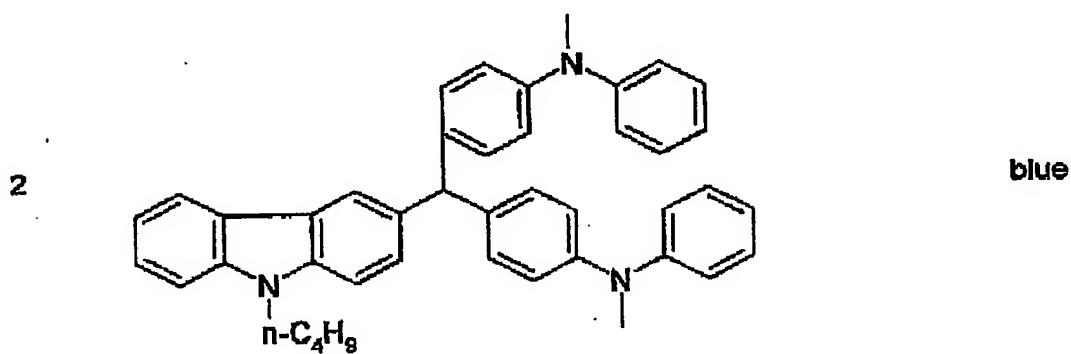
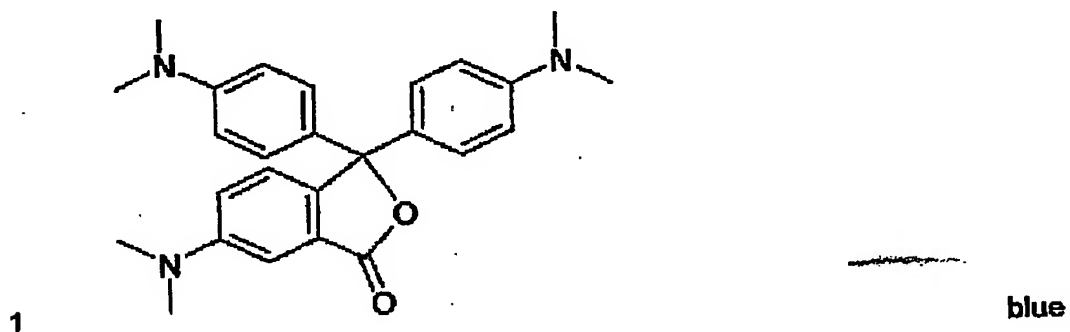
Especially preferred fluoran compounds are 3-(4-diethylamino-2-ethoxyphenyl)-3-(1-ethyl-2-methylindole-3-yl)-4-azaphthalide, 3-(4-diethylamino-2-ethoxyphenyl)-3-(1-octyl-2-methylindole-3-yl)-4-azaphthalide, 3-(4-cyclohexylethylamino-2-methoxyphenyl)-3-(1-ethyl-2-methylindole-3-yl)-4-azaphthalide, 3,3-bis(1-ethyl-2-methylindole-3-yl) phthalide, 3,3-bis(1-octyl-2-methylindole-3-yl) phthalide, mixture of 2-phenyl-4-(4-diethylaminophenyl)-4-(4-methoxyphenyl)-6-methyl-7-dimethylamino-3,1-benzoxazine and 2-phenyl-4-(4-diethylaminophenyl)-4-(4-methoxyphenyl)-8-methyl-7-dimethylamino-3,1-benzoxazine, 4,4'-

[1-methylethylidene)bis(4,1-phenyleneoxy-4,2-quinazolinediyl)]bis[N,N-diethylbenzenamine], bis(N-methyldiphenylamine)-4-yl-(N-butylcarbazole)-3-yl-methane, 3-methyl-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 3-diethylamino-6-p-(p-diethylamino-phenyl)aminoanilino-fluoran, 3-diethylamino-6-p-(p-dibutylaminophenyl)aminoanilino-fluoran, 2,4-dimethyl-6-[(4-dimethylamino)anilino] fluoran, 3,6,6'-tris(dimethylamino)spiro[fluorene-9,3'-phthalide], 3,6,6'-tris(diethylamino)spiro[fluorene-9,3'-phthalide], 3,3-bis(p-dimethylaminophenyl)-6-dimethylaminophthalide, 3,3-bis(p-dimethylaminophenyl)phthalide, 2-diethylamino-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 3-dibutylamino-6-methyl-7-(N-formylmethylamino)-fluoran, 2-methyl-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 2-methoxy-6-p-(p-dimethylaminophenyl)aminoanilino-fluoran, 3-(N-ethyl-N-ethoxypropylamino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-N-tetrahydrofurfurylamino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-N-isobutylamino)-6-methyl-7-anilino-fluoran, 3-(N-methyl-N-propylamino)-6-methyl-7-anilino-fluoran, 3-(N-methyl-N-cyclohexylamino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-N-cyclohexylamino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-p-toluidino)-6-methyl-7-anilino-fluoran, 3-(N-ethyl-N-isoamylamino)-6-methyl-7-anilino-fluoran, 3-dipentylamino-6-methyl-7-anilino-fluoran, 3-dibutylamino-6-methyl-7-anilino-fluoran, 3-diethylamino-7-methylfluoran, 3-diethylamino-7-t-butylfluoran, 3-diethylamino-7-carboxyethylfluoran, 3-diethylamino-7-(dibenzylamino) fluoran, 3-dibutylamino-7-dibenzylaminofluoran, 3-diethylamino-6-methylfluoran, 3-diethylamino-6-methyl-7-(4-n-octylanilino) fluoran, 3-diethylamino-7-(4-n-octylanilino) fluoran, 3-diethylamino-7-(4-n-octylamino) fluoran.

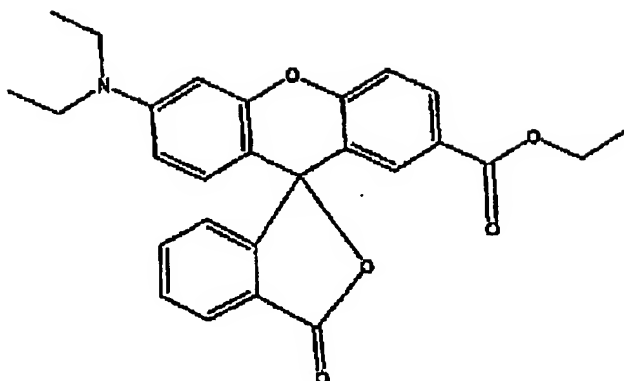
The above colour forming compounds may be used as single compounds or in combination with each other or further colour forming compounds.

Some preferred colour formers are shown in the following table:

No.	Colour former	Shade
-----	---------------	-------

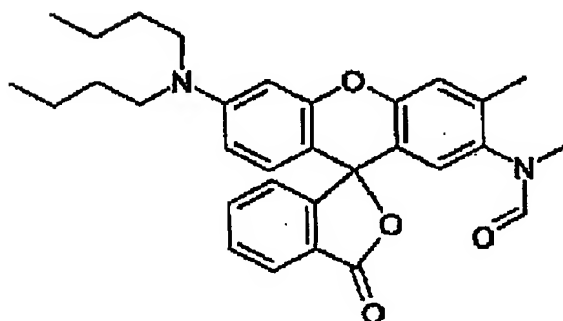


4



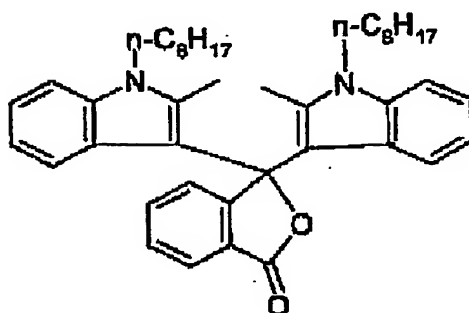
orange

5



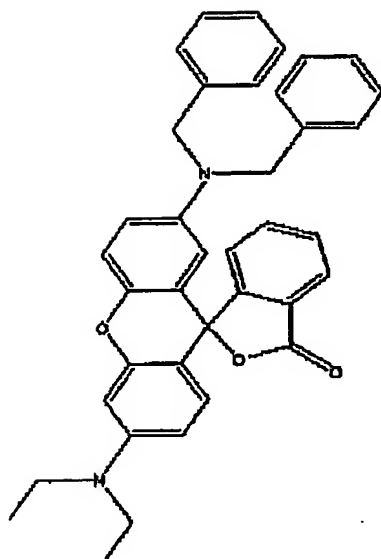
yellow

6



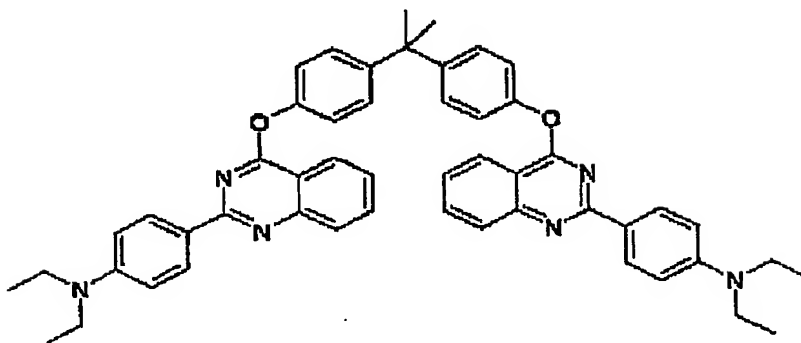
red

7



Green

8



yellow

The polymeric material usually contains 0.001 to 10% by weight, preferably 0.01 to 5% by weight of the phenolic antioxidant and/or phenolic UVA. Of special technical importance is a loading of about 0.3 to 3% by weight of the phenolic antioxidant and/or phenolic UVA (all weight percentages relative to the total weight of the polymeric material). The polymeric material can contain mixtures of two or more of the phenolic antioxidant and/or phenolic UVAs.

The amount of colour former in the polymeric material usually is in the range of about 0.001 to 10% by weight, most preferably 0.01 to 5% by weight of the colour former with respect to the total weight of the polymeric material. The polymeric material can contain mixtures of two or more colour formers.

The ratio of phenolic antioxidant and/or phenolic UVA (a) to colour former (b) can e.g. be in the range of 0.01 to 100 parts of colour former (b) per part of phenolic antioxidant and/or phenolic UVA (a); most preferred is about 0.1 to 10 parts of colour former (b) per part of phenolic antioxidant and/or phenolic UVA (a).

The polymeric material, the colour former and the phenolic antioxidant and/or phenolic UVA usually form a homogenous mixture. For specific applications, however, compositions can be made in which the phenolic antioxidant and/or phenolic UVA and the colour former are enriched in a part of the polymeric material, e.g. in the surface areas.

The components of the invention and optional further additives may be added to the polymer material individually or mixed with one another. The incorporation of the components of the invention and optional further components into the polymer is carried out by known methods such as dry blending in the form of a powder, or wet mixing in the form of solutions, dispersions or suspensions for example in an inert solvent, water or oil. The additives of the invention and optional further additives may be incorporated, for example, before or after molding. They may be added directly into the processing apparatus (e.g. extruders, internal mixers, etc), e.g. as a dry mixture or powder or as solution or dispersion or suspension or melt.

The incorporation can be carried out in any heatable container equipped with a stirrer, e.g. in a closed apparatus such as a kneader, mixer or stirred vessel. The incorporation is preferably carried out in an extruder or in a kneader. It is immaterial whether processing takes place in an inert atmosphere or in the presence of oxygen. The process is preferably carried out in an extruder by introducing the additive during processing.

Particularly preferred processing machines are single-screw extruders, contrarotating and corotating twin-screw extruders, planetary-gear extruders, ring extruders or cokneaders. It is also possible to use processing machines provided with at least one gas removal compartment to which a vacuum can be applied.

Suitable extruders and kneaders are described, for example, in *Handbuch der Kunststoffextrusion*, Vol. 1 Grundlagen, Editors F. Hensen, W. Knappe, H. Potente, 1989, pp. 3-7, ISBN:3-446-14339-4 (Vol. 2 Extrusionsanlagen 1986, ISBN 3-446-14329-7).

For example, the screw length is 1 - 60 screw diameters, preferably 35-48 screw diameters. The rotational speed of the screw is preferably 10 - 600 rotations per minute (rpm), very particularly preferably 25 - 300 rpm.

The maximum throughput is dependent on the screw diameter, the rotational speed and the driving force. The process of the present invention can also be carried out at a level lower than maximum throughput by varying the parameters mentioned or employing weighing machines delivering dosage amounts.

If a plurality of components are added, these can be premixed or added individually.

One or more components of the invention and optional further additives can also be sprayed onto the polymer material. They are able to dilute other additives (for example the conventional additives indicated below) or their melts so that they can be sprayed also together with these additives onto the material. Addition by spraying during the deactivation of the polymerization catalysts may be particularly advantageous; in this case, the steam evolved may be used for deactivation of the catalyst. In the case of spherically polymerized polyolefins it may, for example, be advantageous to apply the additives of the invention, optionally together with other additives, by spraying.

The components of the invention and optional further additives can also be added to the polymer in the form of a masterbatch ("concentrate") which contains the components in a concentration of, for example, about 1 % to about 40% and preferably 2 % to about 20 % by weight incorporated in a polymer. The polymer must not be necessarily of identical structure than the polymer where the components are added finally. In such operations, the polymer can be used in the form of powder, granules, solutions, suspensions or in the form of latices.

Incorporation can take place prior to or during the shaping operation, or by applying the dissolved or dispersed compound to the polymer, with or without subsequent evaporation of the solvent. In the case of elastomers, these can also be stabilized as latices. A further possibility for incorporating the components of the invention into polymers is to add them before, during or directly after the polymerization of the corresponding monomers or prior to crosslinking. In this context the components of the invention can be added as it is or else in encapsulated form (for example in waxes, oils or polymers).

The materials containing the components of the invention described herein are preferably used for the production of plastic articles such as moldings, rotomolded articles, injection molded articles, blow molded articles, films, tapes, mono-filaments, fibers, textiles, nonwovens, profiles, but also for the production of adhesives or putties, surface coatings and the like. Transparent materials are especially preferred.

Depending on the irradiation source used, the invention provides a method for inducing uniform coloration or coloration of specific regions of the polymeric article. Thus, uniformly coloured materials may be obtained as well as labeled articles or images on or in the article.

It is e. g. possible, to dissolve the components in a solvent and then to remove the solvent by evaporation. Another possibility is to melt polymeric material together with the colour former and the phenolic antioxidant and/or phenolic UVA to get a homogeneous mixture or to thoroughly knead a mixture of polymeric material, colour former and phenolic antioxidant and/or phenolic UVA.

In another embodiment, the phenolic antioxidant and/or phenolic UVA is grafted on the polymer material by means known in the art. E.g. the phenolic antioxidant (a) is previously converted into a monomer, i.e. by incorporating a functional group of suitable reactivity, or a monomer is used which is functionalized with a phenolic antioxidant group (e.g. present compounds Nos. 129 or 130). This allows a graft polymerization on the existing polymeric material or a copolymerization during the manufacturing the polymeric material.

The polymeric material can contain further ingredients, e.g. stabilizers, antioxidants, softeners etc. as are commonly used for polymeric material, examples are listed below:

1. Further Phenolic Antioxidants

such as alkylated monophenols, alkylthiomethylphenols, hydroquinones and alkylated hydroquinones, tocopherols, for example β -tocopherol, γ -tocopherol, δ -tocopherol and mixtures thereof (vitamin E); hydroxylated thiodiphenyl ethers, alkylidenebisphenols, O-, N- and S-benzyl compounds, hydroxybenzylated malonates, aromatic hydroxybenzyl compounds, triazine compounds, benzylphosphonates, acylaminophenols, esters of β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid with mono- or polyhydric alcohols, esters of β -(5-tert-butyl-4-

hydroxy-3-methylphenyl)propionic acid with mono- or polyhydric alcohols, esters of β -(3,5-dicyclohexyl-4-hydroxyphenyl)propionic acid with mono- or polyhydric alcohols, esters of 3,5-di-tert-butyl-4-hydroxyphenyl acetic acid with mono- or polyhydric alcohols, amides of β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid, ascorbic acid (vitamin C).

1.2. Aminic antioxidants, for example N,N'-di-isopropyl-p-phenylenediamine, N,N'-di-sec-butyl-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1-methylheptyl)-p-phenylenediamine, N,N'-dicyclohexyl-p-phenylenediamine, N,N'-diphenyl-p-phenylenediamine, N,N'-bis(2-naphthyl)-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine, N-(1-methylheptyl)-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, 4-(p-toluenesulfamoyl)diphenylamine, N,N'-dimethyl-N,N'-di-sec-butyl-p-phenylenediamine, diphenylamine, N-allyldiphenylamine, 4-isopropoxydiphenylamine, N-phenyl-1-naphthylamine, N-(4-tert-octylphenyl)-1-naphthylamine, N-phenyl-2-naphthylamine, octylated diphenylamine, for example p,p'-di-tert-octyldiphenylamine, 4-n-butylaminophenol, 4-butyrylamino-phenol, 4-nonanoylamino-phenol, 4-dodecanoylamino-phenol, 4-octadecanoylamino-phenol, bis(4-methoxyphenyl)amine, 2,6-di-tert-butyl-4-dimethylaminomethylphenol, 2,4'-diaminodiphenylmethane, 4,4'-diaminodiphenylmethane, N,N,N',N'-tetramethyl-4,4'-diaminodiphenylmethane, 1,2-bis[(2-methylphenyl)amino]ethane, 1,2-bis(phenylamino)propane, (o-tolyl)biguanide, bis[4-(1',3'-dimethylbutyl)phenyl]amine, tert-octylated N-phenyl-1-naphthylamine, a mixture of mono- and dialkylated tert-butyl/tert-octyldiphenylamines, a mixture of mono- and dialkylated nonyldiphenylamines, a mixture of mono- and dialkylated dodecyldiphenylamines, a mixture of mono- and dialkylated isopropyl/iso-hexyldiphenylamines, a mixture of mono- and dialkylated tert-butyl/tert-octyldiphenylamines, 2,3-dihydro-3,3-dimethyl-4H-1,4-benzothiazine, phenothiazine, a mixture of mono- and dialkylated tert-butyl/tert-octylphenothiazines, a mixture of mono- and dialkylated tert-octylphenothiazines, N-allylphenothiazine, N,N,N',N'-tetraphenyl-1,4-diaminobut-2-ene, N,N-bis-(2,2,6,6-tetramethyl-piperid-4-yl)-hexamethylenediamine, bis(2,2,6,6-tetramethylpiperid-4-yl)-sebacate, 2,2,6,6-tetramethylpiperidin-4-one, 2,2,6,6-tetramethylpiperidin-4-ol.

2. UV absorbers and light stabilisers

2.1. 2-(2'-Hydroxyphenyl)benzotriazoles, for example 2-(2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(5'-tert-butyl-2'-hydroxyph-

nyl)benzotriazole, 2-(2'-hydroxy-5'-(1,1,3,3-tetramethylbutyl)phenyl)benzotriazole, 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-methylphenyl)-5-chlorobenzotriazole, 2-(3'-sec-butyl-5'-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(2'-hydroxy-4'-octyloxyphenyl)benzotriazole, 2-(3',5'-di-tert-amyl-2'-hydroxyphenyl)benzotriazole, 2-(3',5'-bis(α,α -dimethylbenzyl)-2'-hydroxyphenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-octyloxycarbonylethyl)phenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-5'-[2-(2-ethylhexyloxy)carbonylethyl]-2'-hydroxyphenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-methoxycarbonylethyl)phenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-methoxycarbonylethyl)phenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-octyloxycarbonylethyl)phenyl)benzotriazole, 2-(3'-tert-butyl-5'-[2-(2-ethylhexyloxy)carbonylethyl]-2'-hydroxyphenyl)benzotriazole, 2-(3'-dodecyl-2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-isooctyloxycarbonylethyl)phenyl)benzotriazole, 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-benzotriazole-2-ylphenol]; the transesterification product of 2-[3'-tert-butyl-5'-(2-methoxycarbonylethyl)-2'-hydroxyphenyl]-2H-benzotriazole with polyethylene glycol 300; $[R-CH_2CH_2-COO-CH_2CH_2]_2$, where R = 3'-tert-butyl-4'-hydroxy-5'-2H-benzotriazol-2-ylphenyl, 2-[2'-hydroxy-3'-(α,α -dimethylbenzyl)-5'-(1,1,3,3-tetramethylbutyl)phenyl]benzotriazole; 2-[2'-hydroxy-3'-(1,1,3,3-tetramethylbutyl)-5'-(α,α -dimethylbenzyl)phenyl]benzotriazole.

2.2. 2-Hydroxybenzophenones, for example the 4-hydroxy, 4-methoxy, 4-octyloxy, 4-decyloxy, 4-dodecyloxy, 4-benzyloxy, 4,2',4'-trihydroxy and 2'-hydroxy-4,4'-dimethoxy derivatives.

2.3. Esters of substituted and unsubstituted benzoic acids, for example 4-tert-butylphenyl salicylate, phenyl salicylate, octylphenyl salicylate, dibenzoyl resorcinol, bis(4-tert-butylbenzoyl)resorcinol, benzoyl resorcinol, 2,4-di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate, hexadecyl 3,5-di-tert-butyl-4-hydroxybenzoate, octadecyl 3,5-di-tert-butyl-4-hydroxybenzoate, 2-methyl-4,6-di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate.

2.4. Acrylates, for example ethyl α -cyano- β,β -diphenylacrylate, isooctyl α -cyano- β,β -diphenylacrylate, methyl α -carbomethoxycinnamate, methyl α -cyano- β -methyl-p-methoxycinnamate.

mate, butyl α -cyano- β -methyl-p-methoxycinnamate, methyl α -carbomethoxy-p-methoxycinnamate and N-(β -carbomethoxy- β -cyanovinyl)-2-methylindoline.

2.6. Nickel compounds, for example nickel complexes of 2,2'-thiobis[4-(1,1,3,3-tetramethylbutyl)phenol], such as the 1:1 or 1:2 complex, with or without additional ligands such as n-butylamine, triethanolamine or N-cyclohexyldiethanolamine, nickel dibutyldithiocarbamate, nickel salts of the monoalkyl esters, e.g. the methyl or ethyl ester, of 4-hydroxy-3,5-di-tert-butylbenzylphosphonic acid, nickel complexes of ketoximes, e.g. of 2-hydroxy-4-methylphenylundecylketoxime, nickel complexes of 1-phenyl-4-lauroyl-5-hydroxypyrazole, with or without additional ligands.

2.6. Sterically hindered amines, for example bis(2,2,6,6-tetramethyl-4-piperidyl)sebacate, bis(2,2,6,6-tetramethyl-4-piperidyl)succinate, bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate, bis(1-octyloxy-2,2,6,6-tetramethyl-4-piperidyl)sebacate, bis(1,2,2,6,6-pentamethyl-4-piperidyl) n-butyl-3,5-di-tert-butyl-4-hydroxybenzylmalonate, the condensate of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-hydroxypiperidine and succinic acid, linear or cyclic condensates of N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine and 4-tert-octylamino-2,6-dichloro-1,3,5-triazine, tris(2,2,6,6-tetramethyl-4-piperidyl)nitrilotriacetate, tetrakis(2,2,6,6-tetramethyl-4-piperidyl)-1,2,3,4-butanetetracarboxylate, 1,1'-(1,2-ethanediyl)-bis(3,3,5,5-tetramethylpiperazinone), 4-benzoyl-2,2,6,6-tetramethylpiperidine, 4-stearyloxy-2,2,6,6-tetramethylpiperidine, bis(1,2,2,6,6-pentamethylpiperidyl)-2-n-butyl-2-(2-hydroxy-3,5-di-tert-butylbenzyl)malonate, 3-n-octyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decane-2,4-dione, bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)sebacate, bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)succinate, linear or cyclic condensates of N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine and 4-morpholino-2,6-dichloro-1,3,5-triazine, the condensate of 2-chloro-4,6-bis(4-n-butylamino-2,2,6,6-tetramethylpiperidyl)-1,3,5-triazine and 1,2-bis(3-aminopropylamino)ethane, the condensate of 2-chloro-4,6-di-(4-n-butylamino-1,2,2,6,6-pentamethylpiperidyl)-1,3,5-triazine and 1,2-bis(3-aminopropylamino)ethane, 8-acetyl-3-dodecyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decane-2,4-dione, 3-dodecyl-1-(2,2,6,6-tetramethyl-4-piperidyl)pyrrolidine-2,5-dione, 3-dodecyl-1-(1,2,2,6,6-pentamethyl-4-piperidyl)pyrrolidine-2,5-dione, 5-(2-ethylhexanoyl)-oxymethyl-3,3,5-trimethyl-2-morpholinone, 1-(2-hydroxy-2-methylpropoxy)-4-octadecanoyloxy-2,2,6,6-tetramethylpiperidine, 1,3,5-tris(N-cyclohexyl-N-(2,2,6,6-tetramethylpiperazin-3-on-4-yl)amino)-s-triazine, 1,3,5-tris(N-cyclohexyl-N-(1,2,2,6,6-

pentamethylpiperazin-3-on-4-yl)amino)-s-triazine, the reaction product of 2,4-bis[(1-cyclohexyloxy-2,2,6,6-piperidin-4-yl)butylamino]-6-chloro-s-triazine with N,N'-bis(3-aminopropyl)ethylenediamine), a mixture of 4-hexadecyloxy- and 4-stearyloxy-2,2,6,6-tetramethylpiperidine, a condensate of N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine and 4-cyclohexylamino-2,6-dichloro-1,3,5-triazine, a condensate of 1,2-bis(3-aminopropylamino)ethane and 2,4,6-trichloro-1,3,5-triazine as well as 4-butylamino-2,2,6,6-tetramethylpiperidine (CAS Reg. No. [136504-96-6]); a condensate of 1,6-hexanediamine and 2,4,6-trichloro-1,3,5-triazine as well as N,N-dibutylamine and 4-butylamino-2,2,6,6-tetramethylpiperidine (CAS Reg. No. [192268-64-7]); N-(2,2,6,6-tetramethyl-4-piperidyl)-n-dodecylsuccinimide; N-(1,2,2,6,6-pentamethyl-4-piperidyl)-n-dodecylsuccinimide; 2-undecyl-7,7,9,9-tetramethyl-1-oxa-3,8-diaza-4-oxo-spiro[4,5]decane; 5-(2-ethylhexanoyl)oxymethyl-3,3,5-trimethyl-2-morpholinone; a reaction product of 7,7,9,9-tetramethyl-2-cycloundecyl-1-oxa-3,8-diaza-4-oxospiro-[4,5]decane and epichlorohydrin, 1,1-bis(1,2,2,6,6-pentamethyl-4-piperidyloxycarbonyl)-2-(4-methoxyphenyl)ethene, N,N'-bis-formyl-N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine, a diester of 4-methoxymethylenemalonic acid with 1,2,2,6,6-pentamethyl-4-hydroxypiperidine, poly[methylpropyl-3-oxy-4-(2,2,6,6-tetramethyl-4-piperidyl)]siloxane, a reaction product of maleic acid anhydride- α -olefin copolymer with 2,2,6,6-tetramethyl-4-aminopiperidine or 1,2,2,6,6-pentamethyl-4-aminopiperidine,

2.7. Oxamides, for example 4,4'-dioctyloxyoxanilide, 2,2'-diethoxyoxanilide, 2,2'-dioctyloxy-5,5'-di-tert-butoxanilide, 2,2'-didodecyloxy-5,5'-di-tert-butoxanilide, 2-ethoxy-2'-ethyloxanilide, N,N'-bis(3-dimethylaminopropyl)oxamide, 2-ethoxy-5-tert-butyl-2'-ethoxanilide and its mixture with 2-ethoxy-2'-ethyl-5,4'-di-tert-butoxanilide, mixtures of o- and p-methoxy-disubstituted oxanilides and mixtures of o- and p-ethoxy-disubstituted oxanilides.

2.8. 2-(2-Hydroxyphenyl)-1,3,5-triazines, for example 2,4,6-tris(2-hydroxy-4-octyloxyphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2,4-dihydroxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2,4-bis(2-hydroxy-4-propyloxyphenyl)-6-(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(4-methylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-dodecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-tridecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-butyloxypropoxy)phenyl]-4,6-bis(2,4-dimethyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-octyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethyl)-1,3,5-triazine, 2-

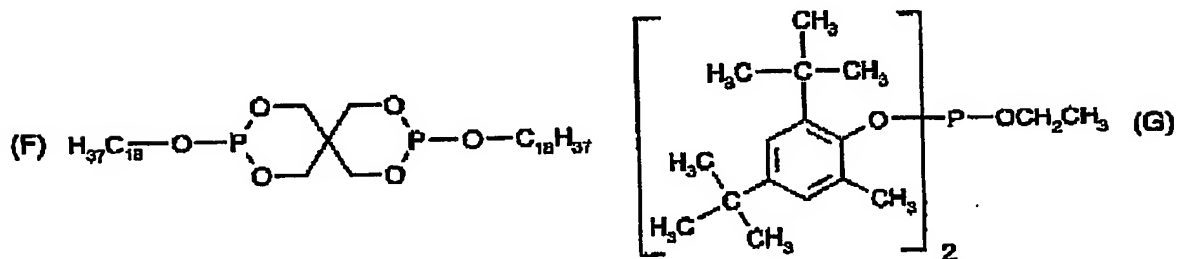
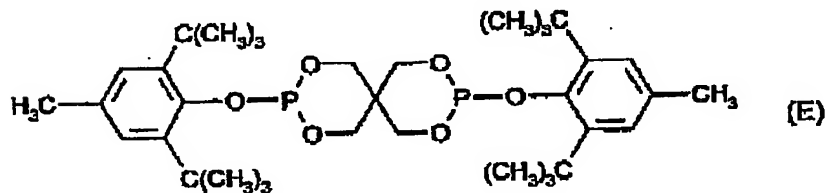
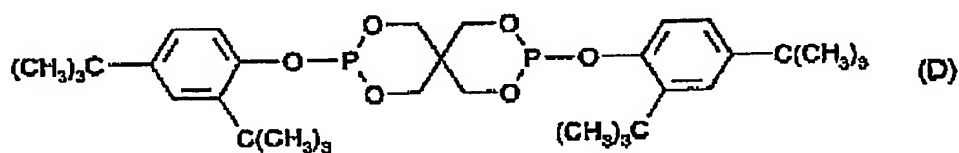
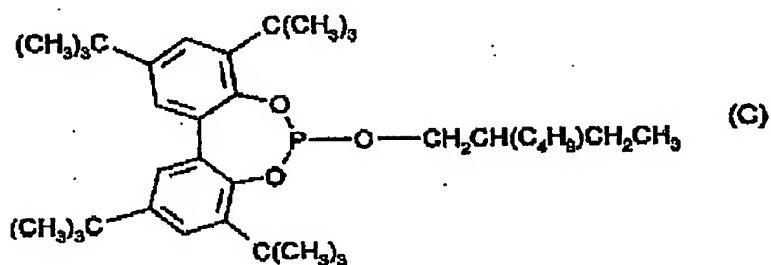
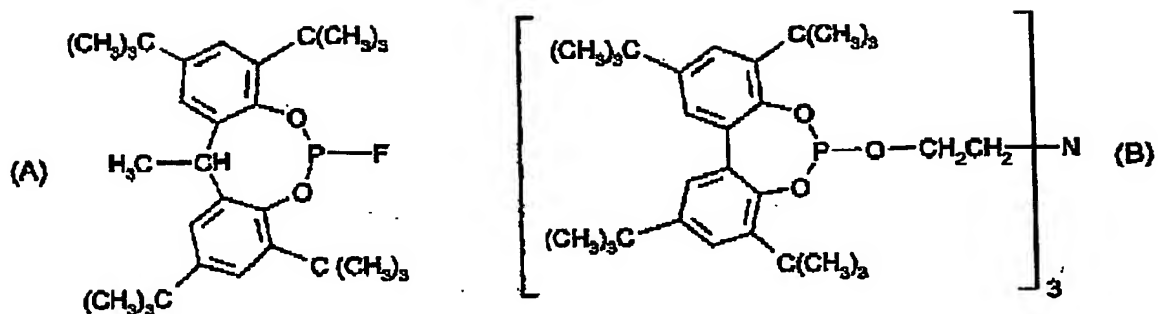
[4-(dodecyloxy/tridecyloxy-2-hydroxypropoxy)-2-hydroxyphenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-dodecyloxypropoxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-hexyloxy)phenyl-4,6-diphenyl-1,3,5-triazine, 2-(2-hydroxy-4-methoxyphenyl)-4,6-diphenyl-1,3,5-triazine, 2,4,6-tris[2-hydroxy-4-(3-butoxy-2-hydroxypropoxy)phenyl]-1,3,5-triazine, 2-(2-hydroxyphenyl)-4-(4-methoxyphenyl)-6-phenyl-1,3,5-triazine, 2-[2-hydroxy-4-[3-(2-ethylhexyl-1-oxy)-2-hydroxypropyloxy]phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine.

3. Metal deactivators, for example N,N'-diphenyloxamide, N-salicylal-N'-salicyloyl hydrazine, N,N'-bis(salicyloyl)hydrazine, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hydrazine, 3-salicyloylamino-1,2,4-triazole, bis(benzylidene)oxalyl dihydrazide, oxanilide, isophthaloyl dihydrazide, sebacoyl bisphenylhydrazide, N,N'-diacetyl adipoyl dihydrazide, N,N'-bis(salicyloyl)oxalyl dihydrazide, N,N'-bis(salicyloyl)thiopropionyl dihydrazide.

4. Phosphites and phosphonites, for example triphenyl phosphite, diphenylalkyl phosphites, phenyldialkyl phosphites, tris(nonylphenyl) phosphite, trilauryl phosphite, trioctadecyl phosphite, distearyl pentaerythritol diphosphite, tris(2,4-di-tert-butylphenyl) phosphite, diisodecyl pentaerythritol diphosphite, bis(2,4-di-tert-butylphenyl) pentaerythritol diphosphite, bis(2,4-di-cumylphenyl) pentaerythritol diphosphite, bis(2,6-di-tert-butyl-4-methylphenyl) pentaerythritol diphosphite, diisodecyloxypentaerythritol diphosphite, bis(2,4-di-tert-butyl-6-methylphenyl) pentaerythritol diphosphite, bis(2,4,6-tris(tert-butylphenyl) pentaerythritol diphosphite, tristearyl sorbitol triphosphite, tetrakis(2,4-di-tert-butylphenyl) 4,4'-biphenylene diphosphonite, 6-isooctyloxy-2,4,8,10-tetra-tert-butyl-12H-dibenz[d,g]-1,3,2-dioxaphosphocin, bis(2,4-di-tert-butyl-6-methylphenyl)methyl phosphite, bis(2,4-di-tert-butyl-6-methylphenyl)ethyl phosphite, 6-fluoro-2,4,8,10-tetra-tert-butyl-12-methyl-dibenz[d,g]-1,3,2-dioxaphosphocin, 2,2',2''-nitriolo-[triethyltris(3,3',5,5'-tetra-tert-butyl-1,1'-biphenyl-2,2'-diyl)phosphite], 2-ethylhexyl(3,3',5,5'-tetra-tert-butyl-1,1'-biphenyl-2,2'-diyl)phosphite, 5-butyl-5-ethyl-2-(2,4,6-tri-tert-butylphenoxy)-1,3,2-dioxaphosphirane.

The following phosphites are especially preferred:

Tris(2,4-di-tert-butylphenyl) phosphite (Irgafos® 168, Ciba-Geigy), tris(nonylphenyl) phosphite,



5. Hydroxylamines, for example N,N-dibenzylhydroxylamine, N,N-diethylhydroxylamine, N,N-dioctylhydroxylamine, N,N-dilaurylhydroxylamine, N,N-ditetradecylhydroxylamine, N,N-dihexadecylhydroxylamine, N,N-dioctadecylhydroxylamine, N-hexadecyl-N-octadecylhydroxylamine, N-heptadecyl-N-octadecylhydroxylamine, N,N-dialkylhydroxylamine derived from hydrogenated tallow amine.

6. Nitrones, for example N-benzyl-alpha-phenylnitron, N-ethyl-alpha-methylnitron, N-octyl-alpha-heptylnitron, N-lauryl-alpha-undecylnitron, N-tetradecyl-alpha-tridecylnitron, N-hexadecyl-alpha-pentadecylnitron, N-octadecyl-alpha-heptadecylnitron, N-hexadecyl-alpha-heptadecylnitron, N-octadecyl-alpha-pentadecylnitron, N-heptadecyl-alpha-heptadecylnitron, N-octadecyl-alpha-hexadecylnitron, nitron derived from N,N-dialkylhydroxylamine derived from hydrogenated tallow amine.

7. Thiosynergists, for example dilauryl thiodipropionate or distearyl thiodipropionate.

8. Peroxide scavengers, for example esters of β -thiodipropionic acid, for example the lauryl, stearyl, myristyl or tridecyl esters, mercaptobenzimidazole or the zinc salt of 2-mercaptobenzimidazole, zinc dibutyldithiocarbamate, dioctadecyl disulfide, pentaerythritol tetrakis(β -dodecylmercapto)propionate.

9. Polyamide stabilisers, for example copper salts in combination with iodides and/or phosphorus compounds and salts of divalent manganese.

10. Basic co-stabilisers, for example melamine, polyvinylpyrrolidone, dicyandiamide, triallyl cyanurate, urea derivatives, hydrazine derivatives, amines, polyamides, polyurethanes, alkali metal salts and alkaline earth metal salts of higher fatty acids, for example calcium stearate, zinc stearate, magnesium behenate, magnesium stearate, sodium ricinoleate and potassium palmitate, antimony pyrocatecholate or zinc pyrocatecholate.

11. Nucleating agents, for example inorganic substances, such as talcum, metal oxides, such as titanium dioxide or magnesium oxide, phosphates, carbonates or sulfates of, preferably, alkaline earth metals; organic compounds, such as mono- or polycarboxylic acids and the salts thereof, e.g. 4-tert-butylbenzoic acid, adipic acid, diphenylacetic acid, sodium succinate or sodium benzoate; polymeric compounds, such as ionic copolymers (ionomers).

Especially preferred are 1,3:2,4-bis(3',4'-dimethylbenzylidene)sorbitol, 1,3:2,4-di(paramethyldibenzylidene)sorbitol, and 1,3:2,4-di(benzylidene)sorbitol.

12. Fillers and reinforcing agents, for example calcium carbonate, silicates, glass fibres, glass beads, asbestos, talc, kaolin, mica, barium sulfate, metal oxides and hydroxides, carbon black, graphite, wood flour and flours or fibers of other natural products, synthetic fibers.

13. Other additives, for example plasticisers, lubricants, emulsifiers, pigments, rheology additives, catalysts, flow-control agents, optical brighteners, flameproofing agents, antistatic agents and blowing agents.

14. Benzofuranones and indolinones, for example those disclosed in U.S. 4,325,863; U.S. 4,338,244; U.S. 5,175,312; U.S. 5,216,052; U.S. 5,252,643; DE-A-4316811; DE-A-4316822; DE-A-4316876; EP-A-0589839 or EP-A-0591102 or 3-[4-(2-acetoxyethoxy)phenyl]-5,7-di-tert-butyl-benzofuran-2-one, 5,7-di-tert-butyl-3-[4-(2-stearoyloxyethoxy)phenyl]benzofuran-2-one, 3,3'-bis[5,7-di-tert-butyl-3-[4-(2-hydroxyethoxy)phenyl]benzofuran-2-one], 5,7-di-tert-butyl-3-(4-ethoxyphenyl)benzofuran-2-one, 3-(4-acetoxy-3,5-dimethylphenyl)-5,7-di-tert-butyl-benzofuran-2-one, 3-(3,5-dimethyl-4-pivaloyloxyphenyl)-5,7-di-tert-butyl-benzofuran-2-one, 3-(3,4-dimethylphenyl)-5,7-di-tert-butyl-benzofuran-2-one, 3-(2,3-dimethylphenyl)-5,7-di-tert-butyl-benzofuran-2-one.

To convert the phenolic antioxidant and/or phenolic UVA into the acid the polymeric material is irradiated. An irradiation source especially useful for marking in this application is UV-light and especially UV-lasers. The lasers used are commercially available. The wavelength of the UV-light preferably is in the range of 285 to 400 nm, more preferably in the range of 285 to 370 nm. The duration of irradiation depends on the components and on the type of UV-source and may easily be determined by routine experiments.

In case that another high-energy radiation source is used, the phenolic antioxidant and/or phenolic UVAs of component (a) described above may be replaced in the present coloring method by another phenolic compound showing activity as latent acid; examples are compounds of the formula (X) or compounds of formulae (2) to (14) described above. Thus, the

present invention further pertains to a method of coloring a polymeric material, wherein a polymeric material containing

- c) a phenolic antioxidant, phenolic UVA and/or a latent acid, and
 - d) a colour former
- is irradiated using a radiation of higher energy than ultraviolet light.

Suitable radiation of higher energy than UV light includes X-ray, γ -ray, or particle radiation such as electron beam. Preferred radiation sources include X-ray or electron radiation sources and radioactive materials emitting α -, β - and/or γ -radiation.

Preferred as component (c) are basically the preferred phenolic antioxidants and/or phenolic UVAs (a) described above, or compounds of the formulae (X) and (2) to (14) described above. Most preferred component (c) in this process are compounds (101) - (133) along with compound No. (13) listed above. Colour formers of component (d) are basically the same as those of component (b) noted above. Dosages of components (c) and (d), preferred polymeric materials and uses thereof are also as initially described.

The invention also relates to clothes containing the components of the present invention. Such clothes will indicate external irradiation by an irreversible color change, e.g. when such clothes are sterilized for instance by gamma-irradiation. Another instance is the use of such clothes in nuclear power stations and nuclear recovery/storage buildings, as protection clothes, e.g. for working staff or civil defense personnel, in case of accident or nuclear attack.

A specific embodiment is an ABC protective clothing containing a polymer material with components (a) and (b) or (c) and (d) of present invention on or visibly below (e.g. covered by a transparent cover layer) its surface, wherein the coloring is effected on irradiation or contact with radioactive material.

Clothes can be based on synthetic or natural fibers. Examples for synthetic fiber materials are well known in the state-of-the-art, e.g. polyester, polyamide, polypropylene, elastane, polyurethane, polyaramide, polyacryl, or other materials known in the art. The fibers are produced mainly in a melt process (fiber spinning) where the inventive compositions can be added. As a result the complete fiber will change the color, when irradiated. These fibers

- 49 -

can be used for making a fabric. These fabrics are suitable for the above mentioned clothes. It is also possible to combine synthetic and natural (like cotton, wool, etc.) fibers into one fabric. Moreover, functional clothes may combine several functionalities, which are based on separate fabric layers. The fabric according to the invention is preferably used on an external, visible part of the complete clothes.

The invention also relates to a process of making a fiber or woven or non-woven fabric, which process comprises adding (a) a phenolic antioxidant and/or phenolic UVA and (b) a colour former to a synthetic polymer before or during the fiber melt spinning process.

These materials or films or plates containing current components (a) and (b) are further useful as tags indicating x-ray or radioactive irradiation. Intensity of irradiation may be monitored by observation of colour development or by comparison of the colour of the irradiated tag or sample with the colour of a tag or sample not irradiated. Thus, present invention further provides a process for monitoring irradiation by X-ray or radioactive material, which process comprises placing a tag or sample of a polymer material comprising components (a) and (b) or (c) and (d) described above in a site to be controlled, and subsequently checking the colour of the tag or sample.

The following non-limitative examples illustrate the invention in more detail. Parts and percentages are by weight, unless otherwise stated.

Examples:

Formulations: 12 g of colour former (3,3-bis(p-dimethylaminophenyl)-6-dimethylaminophthalide) and 12 g of the phenolic antioxidant pentaerythritol tetrakis (3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate) (available as Irganox[®] 1010, Ciba Specialty Chemicals) are mixed in a turbomixer with 1176 g of polypropylene powder (PP, Moplen[®] JE 6100, Basell) having a melt index of 3.0 (measured at 230 °C and 2.16 Kg).

The mixture is extruded at 200-230°C to give polymer granules which are subsequently converted into plaques 1 mm thick, using an injection molding machine (Negribossi - Italy) and working at a maximum temperature of 220°C.

The same procedure is applied for formulations 2, 3 and 4 with the amounts reported in the table below.

Tab. 1: Formulations used

Formulation No.	Colour Former		Phenolic antioxidant		PP
	%	g	%	g	g
1	1	12	1	12	1176
2	0.1	1.2	0.1	1.2	1197.6
3	1	12	0.1	1.2	1186.8
4	0.1	1.2	1	12	1186.8

UV laser imaging: A polypropylene plaque (formulation as in the above Table 1) is irradiated using a Lasertec® UV laser system operating at 355nm, 3kHz, 99.9% power and a scan speed of 15mm/sec. Once imaging is complete, text is clearly visible on the plaque. Repeated imaging leads to more intense image. The plaque is then subjected to artificial daylight for 67 hours on a light rig with an average output of 13,000 Lux. No significant change in the density of the imaged text is discernible. The optical density and L*a*b* values (CIELAB) of the unimaged background of the plaque are measured before and after exposure to artificial daylight using a Gretag SPM50 spectrophotometer. Formulations 2-4 as in the above Table 1 are tested in the same way. The results are compiled in table 2 below.

Tab. 2: Optical density and L*, a*, b* parameters of unimaged background before and after exposure to artificial daylight

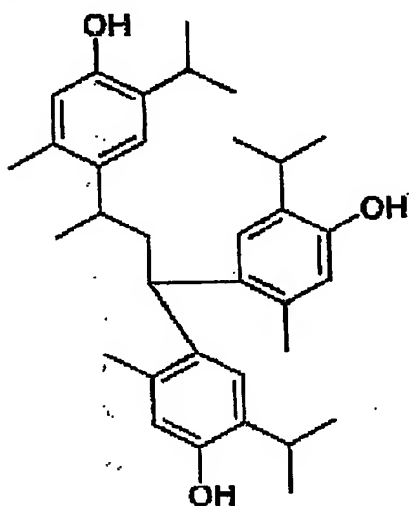
Formulation No.	OD _{max}		L*	a*	b*	L*	a*	b*
	Before	After	Before			After		
2	0.28	0.31	86.95	0.16	8.30	85.03	0.35	8.25
4	0.28	0.31	87.60	0.18	8.10	84.76	0.95	8.26
1	0.69	0.69	70.00	3.68	5.19	69.75	3.19	8.65
3	0.66	0.74	71.67	3.84	5.08	69.20	3.17	9.81

Images obtained as coloration on unirradiated background show good contrast and light stability.

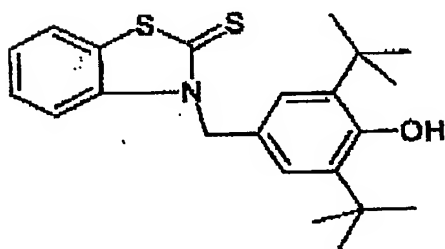
Claims

1. Method of coloring a polymeric material, wherein a polymeric material containing
- a phenolic antioxidant and/or a phenolic ultraviolet absorber and
 - a colour former

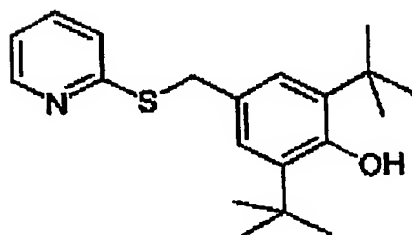
is irradiated using a radiation of higher energy than visible light, provided that the phenolic antioxidant and/or phenolic ultraviolet absorber (a) is not a compound of the formula (2) to (14)



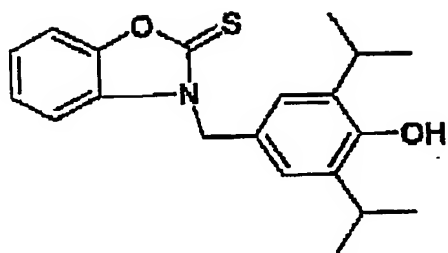
(2)



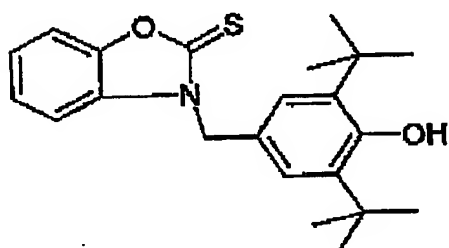
(3)



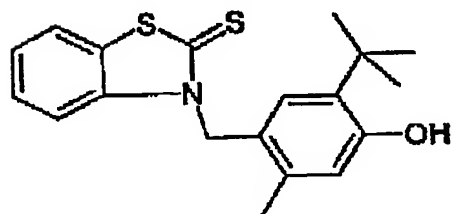
(4)



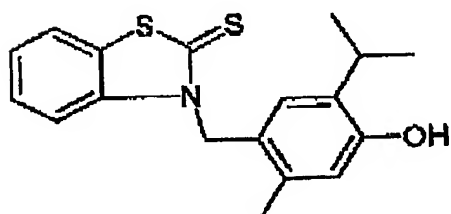
(5)



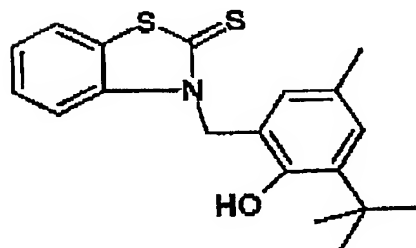
(6)



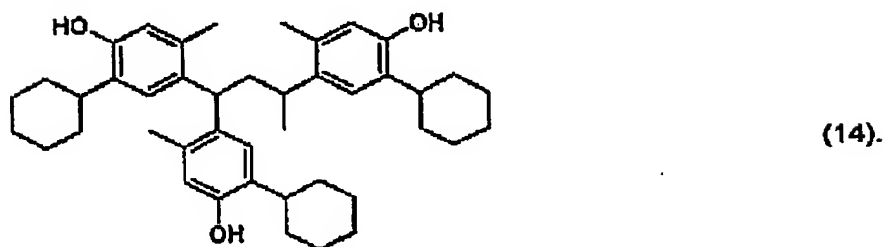
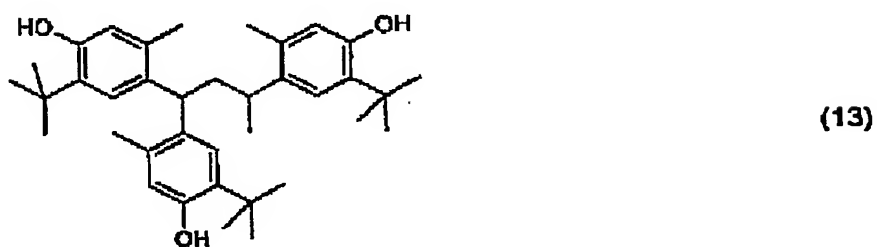
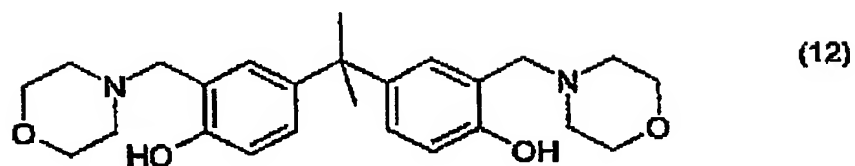
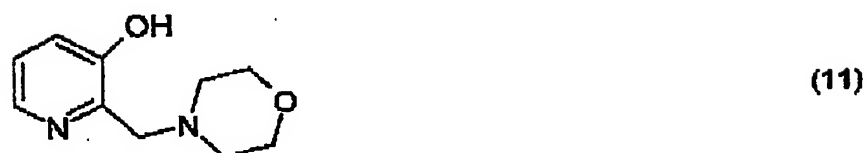
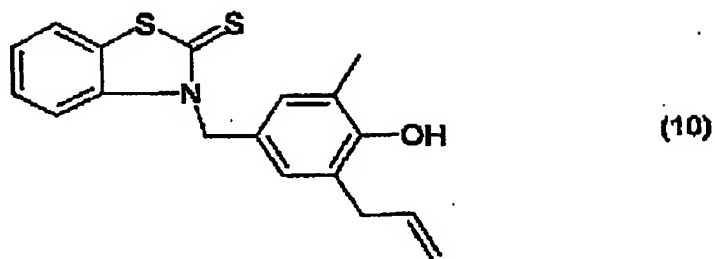
(7)



(8)



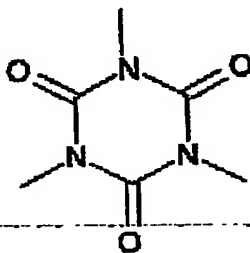
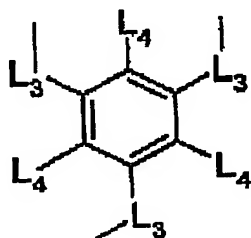
(9)

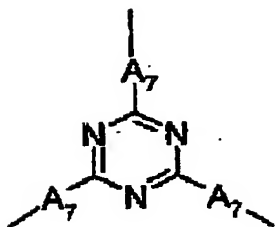


2. Method according to claim 1, wherein the radiation of higher energy than visible light is selected from ultraviolet light, X-ray, gamma radiation and particle radiation, especially from

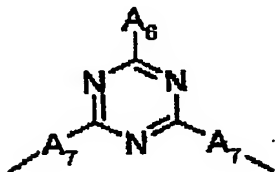
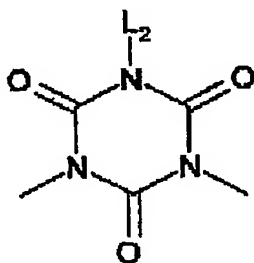
ultraviolet laser or ultraviolet lamp radiation of 285 to 400 nm, electron radiation, X-ray and gamma radiation.

3. Method according to claim 1, wherein component (a) is a compound comprising one or more mono-hydroxyphenyl moieties, each carrying one or two bonds to either a linking group connecting the moiety with 1 to 3 further moieties of the same type or to an anchor group, and optionally 1-3 further substituents selected from alkyl of 1 to 12 carbon atoms, where the linking groups are di-, tri- or tetravalent aliphatic groups of 1 to 20 carbon atoms and divalent linking groups are selected from alkylene which may be interrupted and/or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, a group L_1 , phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy; divalent mono-, di- or tricycloalkylene groups; divalent mono-, di- or tricycloalkylene groups interrupted by $-O-$; spacer groups $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$; trivalent groups are selected from trivalent alkyl groups of 3 to 20 carbon atoms; said trivalent alkyl groups interrupted and/or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, a group L_1 , phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy; or trivalent groups of the formulae





tetravalent groups are selected from
 tetravalent alkyl groups of 4 to 20 carbon atoms; said tetravalent alkyl groups interrupted
 and/or end-capped with -O-, -NH-, -S-, -CO-, -COO-, -OCO-, -NHCO-, -CONH-, a group L₁,
 phenylene, phenylene which is substituted by C₁-C₁₂alkyl and/or C₁-C₁₂alkoxy and/or C₂-
 C₁₂alkanoyloxy and/or C₃-C₁₂alkenoyloxy;
 wherein
 L₁ is a group selected from the formulae

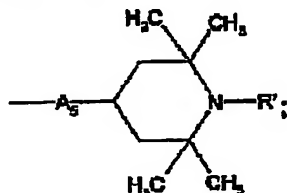


L₂ is OH, C₁-C₁₂alkyl, C₁-C₁₂alkoxy, C₂-C₁₂hydroxyalkyl; C₂-C₁₂hydroxyalkoxy;
 L₃ independently are C₁-C₄alkylene;

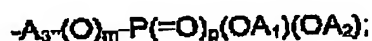
L_4 independently are H or C_1-C_4 alkyl; and

anchor groups are selected from

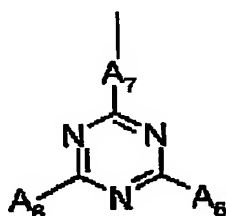
C_1-C_{22} alkyl; C_1-C_{22} alkyl- A_5 ; C_2-C_{22} alkyl interrupted by $-A_5$; $-A_4$ -phenyl; $-A_4$ -phenyl where the phenyl core is substituted by C_1-C_{12} alkyl, C_1-C_{12} alkoxy, C_2-C_{12} alkanoyloxy and/or C_3-C_{12} alkenoyloxy; C_1-C_6 alkyl substituted by a group of the formula



phosphite, phosphate or phosphonate ester groups, e.g. of the formula



or the anchor group is of the formula



where m and p independently are 0 or 1;

A_1 and A_2 independently are C_1-C_{12} alkyl or phenyl or phenyl substituted by C_1-C_{12} alkyl or an equivalent of an alkaline, alkaline earth or aluminum atom;

A_3 is a direct bond or C_1-C_8 alkylene;

A_4 is selected from C_1-C_8 alkylene and A_5 ;

A_5 is selected from $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

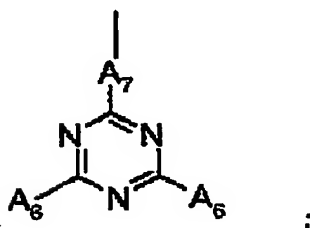
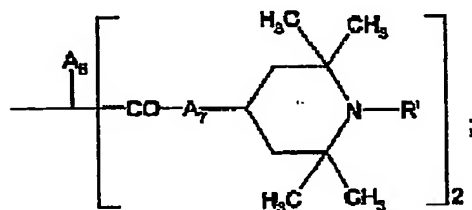
A_6 is selected from C_1-C_{16} alkoxy, C_1-C_{16} alkylthio and C_1-C_{16} alkylamino;

A_7 is $-O-$ or $-NH-$;

R' is H, C_1-C_{16} alkyl, C_1-C_{16} alkoxy or cyclohexyloxy;

or the anchor group is C_3 - C_{22} alkylene or C_3 - C_{22} oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-hydroxyphenyl moiety.

4. Method according to claim 3, wherein the anchor groups are selected from tertiary C_4 - C_{12} alkyl; C_1 - C_{22} alkyl- A_5 -; C_2 - C_{22} alkyl interrupted by $-A_5$ -; $-A_5$ -phenyl; $-A_5$ -phenyl where the phenyl core is substituted by C_1 - C_{12} alkyl; $-A_4$ -phenyl where the phenyl core is substituted by C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy, and optionally further by C_1 - C_{12} alkyl; or the anchor group is C_3 - C_{22} alkylene or C_3 - C_{22} oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-hydroxyphenyl moiety; or is a group of one the formulae



where m and p independently are 0 or 1;

A_1 and A_2 independently are C_1 - C_{12} alkyl or phenyl or phenyl substituted by C_1 - C_{12} alkyl or an equivalent of an alkaline, alkaline earth or aluminum atom;

A_3 is a direct bond or C_1 - C_8 alkylene;

A_4 is selected from C_1 - C_8 alkylene, $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

A_5 is selected from $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

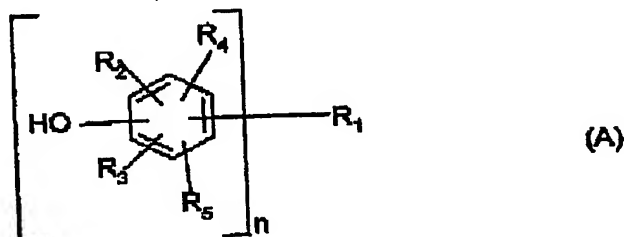
A_6 is selected from C_1 - C_{18} alkoxy, C_1 - C_{18} alkylthio and C_1 - C_{18} alkylamino;

A_7 is $-O-$ or $-NH-$;

A_8 is C_1-C_7 alkyl;

R' is C_1-C_{18} alkyl.

5. Method according to claim 3, wherein component (a) is a compound of the formula (A)



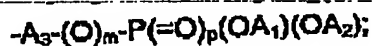
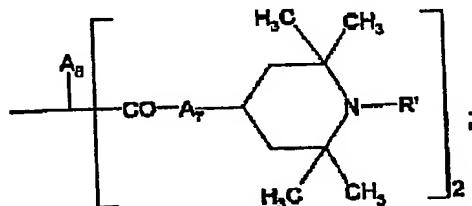
wherein

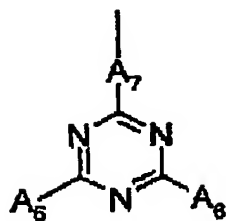
R_2 , R_3 , R_4 and R_5 independently are hydrogen, methyl or tertiary C_4-C_{12} alkyl, especially methyl, tert.-butyl and tert.-pentyl;

n is from the range 1-4;

when n is 1,

R_1 is tertiary C_4-C_{12} alkyl; C_1-C_{22} alkyl- A_5- ; C_2-C_{22} alkyl interrupted by $-A_5-$; $-A_5$ -phenyl where the phenyl core is substituted by C_1-C_{12} alkyl; $-A_4$ -phenyl where the phenyl core is substituted by C_2-C_{12} alkanoyloxy and/or C_3-C_{12} alkenoyloxy, and optionally further by C_1-C_{12} alkyl; or R_1 together with R_5 is C_3-C_{22} alkylene or C_3-C_{22} oxaalkylene attached with both open bonds to adjacent carbon atoms of the mono-hydroxyphenyl moiety; or is a group of one the formulae





where m and p independently are 0 or 1;

A_1 and A_2 independently are C_1 - C_{12} alkyl or phenyl or phenyl substituted by C_1 - C_{12} alkyl or an equivalent of an alkaline, alkaline earth or aluminum atom;

A_3 is a direct bond or C_1 - C_8 alkylene;

A_4 is selected from C_1 - C_8 alkylene, $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

A_5 is selected from $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

A_6 is selected from C_1 - C_{18} alkoxy, C_1 - C_{18} alkylthio and C_1 - C_{18} alkylamino;

A_7 is $-O-$ or $-NH-$;

A_8 is C_1 - C_7 alkyl;

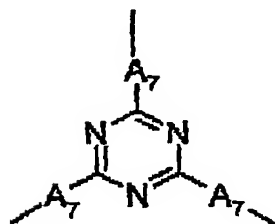
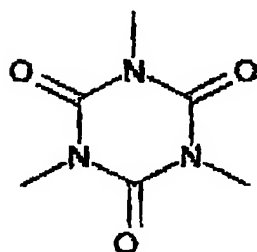
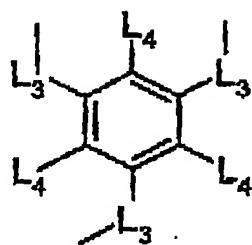
R' is C_1 - C_{18} alkyl;

when n is 2, R_1 is C_1 - C_{20} alkylene which may be interrupted and/or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, $-L_1-$, phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy;

divalent mono-, di- or tricycloalkylene groups; divalent mono-, di- or tricycloalkylene groups interrupted by $-O-$; spacer groups $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

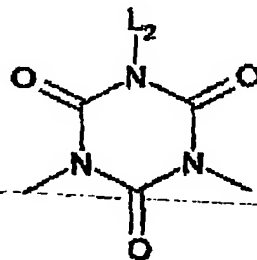
when n is 3, R_1 is trivalent alkyl of 3 to 20 carbon atoms; said trivalent alkyl interrupted or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, $-L_1-$, phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy; or trivalent groups of the formulae

- 60 -

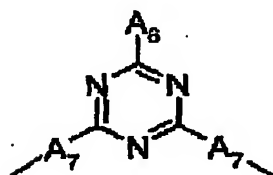


when n is 4, R_1 is tetravalent alkyl of 4 to 20 carbon atoms; said tetravalent alkyl interrupted or end-capped with $-O-$, $-NH-$, $-S-$, $-CO-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, $-L_1-$, phenylene, phenylene which is substituted by C_1 - C_{12} alkyl and/or C_1 - C_{12} alkoxy and/or C_2 - C_{12} alkanoyloxy and/or C_3 - C_{12} alkenoyloxy;

L_1 is a group selected from the formulae



- 61 -



L_2 is OH, C_1 - C_{12} alkyl, C_1 - C_{12} alkoxy, C_2 - C_{12} hydroxyalkyl; C_2 - C_{12} hydroxyalkoxy;

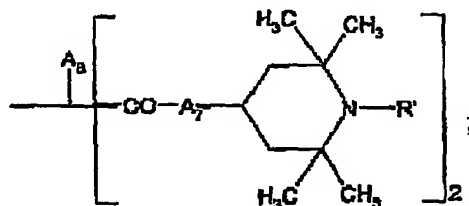
L_3 independently are C_1 - C_4 alkylene;

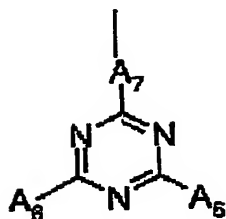
L_4 independently are H or C_1 - C_4 alkyl.

6. Method according to claim 5, wherein R_2 , R_3 , R_4 and R_5 independently are hydrogen, methyl, tert.-butyl, tert.-pentyl;

when n is 1,

R_1 is tertiary butyl, tertiary pentyl; C_1 - C_{22} alkyl- A_5 -; C_2 - C_{22} alkyl interrupted by $-A_5-$; $-A_5$ -phenyl where the phenyl core is substituted by C_1 - C_{12} alkyl; $-A_4$ -phenyl where the phenyl core is substituted by C_3 - C_4 alkenoyloxy and C_1 - C_{12} alkyl; or R_1 together with R_5 is C_2 - C_{22} alkylene or C_3 - C_{22} oxaalkylene attached with both open bonds to adjacent carbon atoms of the monohydroxyphenyl moiety; or R_1 is a group of one the formulae





A_1 and A_2 independently are C_1 - C_4 alkyl or an equivalent of a metal atom selected from Li, Na, K, $\frac{1}{2}$ Mg, $\frac{1}{3}$ Ca, $\frac{1}{3}$ Al;

A_3 is methylene;

A_4 is C_1 - C_8 alkylene;

A_5 is selected from $-O-$, $-S-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

A_6 is selected from C_4 - C_{16} alkylthio and C_4 - C_{16} alkylamino;

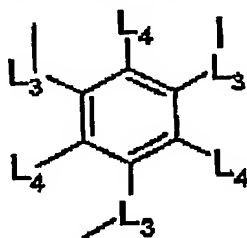
A_7 is $-NH-$;

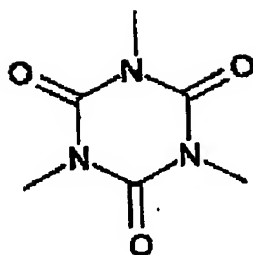
A_8 is C_1 - C_7 alkyl;

R' is C_1 - C_{16} alkyl;

when n is 2, R_1 is C_1 - C_{12} alkylene; C_2 - C_{20} alkylene interrupted and/or end-capped with $-O-$, $-S-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, $-L_1-$; or R_1 is a divalent mono-, di- or tricycloalkylene group; or R_1 is $-O-$, $-NH-$, $-S-$;

when n is 3, R_1 is trivalent alkyl of 3 to 20 carbon atoms; said trivalent alkyl interrupted by $-O-$, $-S-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$, phenylene, phenylene which is substituted by C_1 - C_{12} alkyl; or R_1 is a trivalent group of one of the formulae





when n is 4, R_1 is tetravalent alkyl of 4 to 20 carbon atoms; or said tetravalent alkyl interrupted by $-O-$, $-S-$, $-COO-$, $-OCO-$, $-NHCO-$, $-CONH-$;

L_1 is a group of the formula



L_2 independently are C_1 - C_4 alkylene;

L_4 independently are H or C_1 - C_4 alkyl.

7. Method according to claim 1, wherein the colour former is a triphenylmethane, lactone, benzoxazine, spiropyran or preferably fluoran or phthalide.

8. Method according to claim 1, wherein the polymeric material contains 0.001 to 10 % by weight of the phenolic antioxidant and/or phenolic UVA, based on the total weight of the polymeric material.

9. Method according to claim 1, wherein the polymeric material contains 0.001 to 10 % by weight, preferably 0.01 to 5 % by weight of the colour former with respect to the total weight of the polymeric material.

10. Method according to claim 1, wherein the polymeric material is a transparent thermoplast.

11. Method according to claim 1, wherein the polymeric material is selected from styrene acrylonitrile copolymer, polyolefin, polyvinylchloride, polychlorobutadiene, polyesters and glycol modified polyesters, polyacrylics, polystyrene, acrylonitrile styrene acrylate copoly-

- 64 -

mer, polyamide, acrylonitrile styrene butadiene copolymer, polycarbonate, or blends or alloys thereof.

12. Method of coloring a polymeric material, wherein a polymeric material containing

c) a phenolic antioxidant, phenolic ultraviolet absorber and/or a latent acid, and

d) a colour former

is irradiated using a radiation of higher energy than ultraviolet light.

13. Protective clothing or mask or irradiation indicating tag, wherein a polymer material comprising components (c) and (d) according to claim 12 in form of a fiber, textile, nonwoven or film is contained on visibly below the surface of the clothing or tag.

14. Process for monitoring irradiation by X-ray or radioactive material, which process comprises placing a tag or sample of a polymer material comprising components (c) and (d) according to claim 12 in the site to be controlled, and subsequently checking the colour of the tag or sample.

15. Use of a polymer material comprising components (c) and (d) according to claim 12 for detecting irradiation by X-ray or radioactive material.

16. Process of making a fiber or woven or non-woven fabric, which process comprises adding (a) a phenolic antioxidant and/or phenolic UVA and (b) a colour former to a synthetic polymer before or during the fiber melt spinning process.

- 65 -

Abstract

Polymeric material, containing a phenolic antioxidant and/or phenolic UVA and a colour former is unchanged by visible light and may be coloured by irradiation with energy higher than visible light.

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ ~~BLURRED OR ILLEGIBLE TEXT OR DRAWING~~
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ ~~LINES OR MARKS ON ORIGINAL DOCUMENT~~
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.